

# ANNALS of SURGERY

VOL. LXXXV

MARCH, 1927

No. 3

## THE INFLUENCE OF TRADITION IN SURGERY\*

BY HUBERT A. ROYSTER, M.D.  
OF RALEIGH, N. C.

IN ONE of his delightful essays Sir Clifford Allbutt voices his belief that "medicine was saved by the honor and vitality of its surgery from the fictions and the petrifications of philosophical systems," and "that surgery, though scorned by the high stomachs of the Middle Ages, has never been the child or the humble companion of medicine, but the stone of the corner and the key to its true method." When a great internist thus extols our art, there is placed upon us who devote ourselves to its service the burden of deserving such praise and the responsibility of proving our respectable descent. Moreover, when our confrére further testifies that to certain professional ancestors "our debt is rather one of preservation of good tradition than of discovery," interest awakens in those first things deposited in the cornerstone to be unlocked only by the true key.

Tradition, I confess, has ever intrigued me, has always caught my imagination. There is somewhat of savory satisfaction in the thought of doctrines, methods and customs literally handed down from antecedents to posterity, from one generation to another, from forefathers to descendants by word of mouth without written memorials. And this is tradition. It constitutes the core of truth in some great ecclesiastic sects; it forms the nuclear basis of permanent fraternal orders; it saves for the world what is worshipful in pottery, in painting, in all the work of artists and artisans—this giving over from father to son, nay, to all those in a family, a way of reproducing the Good, the True, the Beautiful.

"Nobody can make a tradition," protests a character of Hawthorne's, "it takes a century to make it." But its transmission adown the generations of men is near to creative expression in that it preserves, and mayhap meliorates, the process. That which is handed down may be an intangible, imponderable thing—a statement, an opinion, a body of knowledge; or merely a trick of the hands, a mixture of dyes, a mechanical form. Yet it is real and composes the finer art, no doubt, for that it is not reduced to printed words.

Yet written tradition remains. A practice brought down over a long number of years is finally put into writing and carried on forever afterward as an accepted method. This is none the less a traditional precept in its conception and its character. After all, as Lowell puts it, "there is only one

\* President's address before the Southern Surgical Association, December 15, 1926.

HUBERT A. ROYSTER

thing better than tradition, and that is the original and eternal life out of which all tradition takes its rise."

In a sense the line between tradition and myth is often difficult to distinguish. One may merge into the other. The differentiating mark is to determine whether the doctrines stand the test of time, whether they remain through the ages as lasting verities, or whether they have faded and been cast aside in the light of progressive knowledge. When ancient practices fail to correspond to modern experience you may be sure they are spurious. But, if they sustain and strengthen as years accumulate, their real merit is attested. As Haldane warns, however, that "we must learn not to take traditional morals too seriously," so perhaps it behooves us not to lay too indiscriminate a hold upon all that is passed down to us, but cleave only unto the "preservation of good tradition," that which abides, which becomes part and parcel of our practice.

Are there not valid traditions in surgery? Are we not beholden to an extensive mass of oral information, inexact records, if you will,—evidence of things far in the past, imparted from the earliest times to the present? Are we not dependent upon a continuing compact of truth, thought out and tried out, borne to us through centuries from seer to student in personal contact over and above what has been written? How else account for the perseverance of our surgical saints in the Dark Ages? Truly the preservation of tradition in surgery has contributed to its succession no less than the published treatise or the written word. Tested method handed down from master to pupil is quite as valuable as, and doubtless more impressive than, the studied statement recorded on the printed page. No derogation here shall lie upon the records of our art; without them we should not have advanced, we would have been deprived of the greater knowledge of the past, and we could not now carry the gospel of surgery to all peoples. Take away surgical tradition, however, and you wipe out the personal impression, the inspired example, the visualized achievement.

From the beginning tradition has established itself in surgery. Certain primæval principles which have endured are now our common property, a fixed part of our knowledge and our performance, put into play without a thought of their derivation. So glibly do we practice the precepts of our fathers that we forget, if we ever knew, the basic source, from which come the tenets of our faith. Though "tradition wears a snowy beard," not all its elder doctrines are decadent nor all its newer postulates perfect.

"But what are true, alas! they are not new,  
And what are new, they are, alas! not true."

What is old may appear very new, and what seems new may be very old. Really, "nothing is so new as what has been long forgotten." Not soon shall I forget the great Halsted, scheduled to present before a session of the Southern Surgical Association his original work on banding an aneurism, but instead throwing open upon the desk a book, found in a library the night before, containing a complete description including colored plates, of an

## THE INFLUENCE OF TRADITION IN SURGERY

identical method published by a French physician in the eighteenth century. The tribute of an open-minded investigator to the esteem of "whatsoever things are true."

Surgical traditions, then, whether ancient or modern, have lived to influence later times, only if they were genuine and successful. Adoration of a fetish or the exaltation of spurious doctrines, originating in charlatanical minds, can lay no claim for regard. Our faithful fellows of the olden times saw to it that these false practices were discarded, that ineffective methods were improved. Paré, the renowned pragmatist, "opened a new era for surgery," according to Packard, "by revealing to the surgical world the value of personal experience combined with a knowledge of the science of surgery, as contrasted with the slavish submission to traditional dogma which had heretofore prevailed." Is it not something to overturn older traditions, unearth the good in others, or substitute fresher and sounder ones? This is the way the spirit of real tradition works. The traditions of surgery have come down to us in long procession and they are still in the making. To-day's unwritten method may be the tradition of to-morrow. Recall our comments upon the "new" and the "true." Says Paré to his critic, the "little master": "To tie the vessel after amputation is a new remedy,' say you, 'therefore it should not be used.' This is badly argued for a doctor."

As well as I have been permitted to separate them, the surgical traditions coming from the remotest times, constituting a part of our present heritage, occur to me in three aspects: the intellectual, the moral and the technical. These divisions, indeed, contain the three essential ingredients for the making of a good surgeon in any age—a clear head, an honest heart and a skilful hand.

Those principles handed down chiefly through the intellect would comprise knowledge gained by study of cases and watching the effects of certain practices; information derived from discussions at the time of, or after, the examination of patients. Mere trying out, however, cannot compensate for intelligent instruction, for "experience is fallacious." But,

"He who doth strive against experience,  
Is not worthy to discourse of high science."

The moral traditions of surgery have had to do largely with cultivation of sound judgment, appreciation of the human element and recognition of the personal equation. These qualities are innate rather than acquired, but are capable of remarkable development in the right kind of an individual. Standards of ethics and codes of conduct are designed to uphold compliance with the highest conceptions. But how fruitless are written rules of deportment! Those who need them are hardly to be bound by them; and those who would feel bound by them do not need them. More than all in the matter of the moral perception of the surgeon is his association with "those of like faith and order," an imbibing of the inner essence from leaders and teachers who are worthy of admiration, of imitation. In no wise better than by tradition can judgment, personality and humanity in surgery be exemplified. Right constantly one is able to estimate a colleague's surgical class by knowing

## HUBERT A. ROYSTER

his instructors, his senior officers, his associates, particularly those whom he strives to copy. The earmarks of tradition stand out strong—the unconscious working of precept and example, more potent and protracted in its sway than mere written words.

Technical tradition is no whit less important or less ethical than that attained through the intellect and the spirit. In truth the mechanical side of surgery, nothing more than the coördination of head and hand, combines the attributes of both the previous principles. Emphatically character shows in the surgeon's handiwork. Conscientious technic is the sign of a high moral purpose expressed in its most practical form. Tradition here plays a powerful part. What is described and printed often is not near so striking as what is demonstrated and passed on. Both means are essential. Description and illustration form the best alliance; knowing how and showing how produce the most effectual arrangement. "The operations of surgery," said Paré, "are learnt by the eye and by the touch." So much the more valuable, then, is the education of the surgeon which comes through observation and experience, bolstered up by previous drilling in fundamental knowledge, and guided by the personal hand of a preceptor, rather than through a helpless dependence upon theoretical instruction without a thorough training in actual contact with a competent and commanding master. Further from me than anyone else I know is any intention to flout the close study of surgical literature or the immense benefit resulting from mental and cultural preparation for the surgeon's career. Learning everything possible from these sources as well as acquiring all that comes through the great body of tradition brings us to the ideal every loyal surgeon strives to reach. We find difficulty in appreciating the unwritten unless we know the written; we cannot reap the largest advantage of the practical unless we are acquainted with the theoretical.

Examples are not wanting in surgical annals to show the weight of tradition. The great pioneers passed on to us through their apprentices and successors most precious truths and wholesome practices. Their followers added to, or subtracted from, these methods, as the need might be. Even down to this period the force, often insensible force, of traditional experience is recognized. Not all the ancient lore of our surgical sages has come down to us either in documentary or in unwritten memorials; much of each is unworthy of transmission. What has been written is available for all; that which was handed from person to person has had an unconscious influence upon every one of us. And behind what was preserved in writing stand the greater unsaid, yet loud speaking things—character, prestige, truth.

The professional "Father" of us all sets the pace in his famous works, long since made available for perpetual record. Beyond and above all that he wrote, between the lines of his every page, may be seen the stamp of tradition, furnishing the motif, enveloping the scene. Hear the immortal Hippocrates as he describes the setting of an operation: "The things relating to surgery are—the patient; the operator; the assistants; the instruments; the light, where and how; how many things, and how; where the body, and the instru-

## THE INFLUENCE OF TRADITION IN SURGERY

ments; the time; the manner; the place." Further: "the operator is either sitting or standing, conveniently for himself, for the person operated upon, for the light." Again: "The robe, in a neat and orderly manner, is to be thrown over the elbows and shoulders equally and proportionally." Specifically, he advised that "the nails should be neither longer nor shorter than the points of the fingers; and the surgeon should practice with the extremities of the fingers, the index-finger being usually turned to the thumb; when using the entire hand, it should be prone; when both hands, they should be opposed to one another. . . . One should practice all sorts of work with either of them, and with both together (for they are both alike), endeavoring to do them well, elegantly, quickly, without trouble, neatly and promptly." Speaking of instruments, he counsels that they are to be handled "so that they may not impede the work, and that there may be no difficulty in taking hold of them. . . . But if another gives them, he must be ready a little beforehand, and do as you direct."

What a lesson in detail is this orderly recital of surgical technic, surely not to be despised in this modern day! Can we not perceive in the background of the picture the glowing personality of the master, the enthusiasm and energy, the inner fire and the holy zeal, inexpressible in words? He treats of the preparation for the operation, putting the patient first and the place last. He considers the position of the surgeon and his relation to the light. He lays stress upon the operating gown and its proper adjustment. He devotes care to the finger-nails and the use of the hands, apparently advising the surgeon to become ambidextrous—a suggestion which the elder Ashhurst, however, deprecated as likely to bestow upon the operator two left hands. Lastly, he notes what is perhaps the greatest gift in an assistant—anticipation.

The reason that Galen dominated medical and surgical thinking for over fifteen hundred years, was his reliance upon practical evidence and his talent in demonstrating its application. Arabian physicians were largely instrumental in upholding and carrying on Galen's teachings. It has been said of Vesalius that "he cast aside tradition and saw with his own eyes." But did he lose the spirit of ancient learning or despise the truth as handed down from his forbears? Undoubtedly not; for from the same source as this criticism comes the admission that Vesalius not only did not overthrow Galen, but was his follower in science—improved on him, corrected many of his errors, but nevertheless stuck to the doctrines of his teacher. Although the supreme contribution of Haller was his voluminous work on the history and literature of surgery, yet his important accomplishment, in Mumford's view, was "his teaching surgeons how to study," and "by his example he did more even than by his preaching."

If there ever was one among us who both absorbed and generated tradition, it was John Hunter. In his early life, untutored in letters and uninformed of what had been done before him, he became later associated with educated companions and lived in an environment from which he

## HUBERT A. ROYSTER

derived profound knowledge. Always, however, "he did his own thinking" and he was conspicuously able to pass that thinking on to others in most vivid fashion. He had a passionate disdain for published dissertations and held to methods of demonstration and experimentation. His young pupils were inspirited and lifted up by close communion with this embodiment of genius.

The imperishable Joseph Lister, without whose life and labors we would not, here assembled, discuss surgical problems of the cranial cavity, the abdomen, the joints, the thorax, nor revel in the unblemished healing of our wounds, was preëminently a child of tradition in surgery. By inheritance and education his training was that obtained in the usual line of association with the highest type of surgeons in his day. He received the best instruction and embraced the widest opportunities of his time. But he went his colleagues one better: he observed and pondered over and was awakened by what they had taken as a matter of course. He was fired by a glow of discontent. He put together what had been handed down to him, conquered the most terrible enemy in the domain of surgery, and forthwith made a new tradition. His disciples dispensed his doctrine and his procedure, not to change his principles, only to perfect his methods. And what one of us has not gained more from transmitted Listerian tradition, from knowledge acquired at the hands of those who were with "The Chief," than from information secured in the perusal of his written theses? In truth I might venture the assertion that scarcely one of us has read the published papers of Lister from his earliest studies up to his final address. And yet from those pioneer pupils who went from the uttermost parts of the earth to worship at his sanctuary, the whole surgical world soon heard the tidings of antisepsis.

What shall be said of surgical tradition in this newer age? It still exists; nay, let us hope, even the older spirit has not departed. Who among us does not feel the satisfying reflection of a former fellowship with a teacher, a preceptor, a "chief," source of the light that has never failed? Do we not count our apprenticeship with such men the crowning glory of our experience? Far more penetrating and memorable are the concrete sayings and doings of these men than any collections of their writings or transcripts of their lectures. Understand me: study of surgical authors is essential to a broad conception of our science; it should be encouraged, required, insisted on. But the highest development of the art of surgery can come only through traditional association. Think of Gross, Treves, Kocher, merely in terms of their texts and they stand out, of course, above their fellows; but consider them intimately in the radiance of what they brought out in their assistants and students and they shine on as stars that cannot be dimmed.

With what measure shall we appraise the value of the teaching transmitted by a Richardson, a Murphy, or an Ochsner to those so fortunate as to come within their circle? And who would exchange this inner acquisition for the knowledge gained from their printed words, clear and cogent though they be? We of the younger time may well pause and contemplate our privilege in the possession of sound surgical tradition as exhibited in our own contemporar-

## THE INFLUENCE OF TRADITION IN SURGERY

ies: the eminent and masterly Mayo; the skilful and daring Deaver; the scholarly, scientific Matas; the sane, resourceful Finney. Consecrated allegiance to the innermost spirit of these our leaders, providential contact with them in their professional life, will bring us to a realization of what faithful tradition they in turn have brought down the path of the ages. There is something to be won from this companionship that comes in no other way. And what it is we may not know. It may be the touch, the presence, the attitude, the word by the way. But there it is, if we find it.

It means much to have been with the masters. Not all of us, unfortunately, can trail with the great, or find opportunities for training under the celebrated of the earth. But we can cling to "good tradition" wheresoever we recognize it. Beside the masters of repute there are also masters in spirit, for some most unsung are most inspired. They, too, link the fundamentals of one period with those of another. I agree with those who believe that the highest attainment of a teacher is to raise up pupils greater than himself. Thus the ambition of a surgeon should be to develop at least one competent successor. This may be an almost impossible objective with a few; it should be the goal of all, so that there may be fulfilled the prophecy, "and greater works than these shall he do." It can be brought to pass only through the vital bond of tradition, literally the handing over of knowledge from master to apprentice. Through this channel alone can be carried forward the expanding ideas of our progressive science, each succeeding generation bettering its predecessor, each fellow of the craft bringing up an understudy who may bear the standard still higher.

Newer and wider knowledge will surely arrive, simpler and better methods must be found, but certain principles are eternal. There are surgeons who are tempted into the belief that change necessarily means improvement; there are some who stubbornly decline to consider any variation from fixed usage; there are still others who, while refusing to be governed "by doctrines fashioned to the varying hour," yet willingly and eagerly take hold of the new, if it be true; who discontinue their customary methods and discard their pet practices whenever a better way is opened. This is the truer part. In such an attitude one keeps unsullied the traditions of the past and by the same sign looks for added wisdom throughout the succeeding years.

The young aspirant of the present period has not only extensive opportunities for educating himself under the individual teacher, but also abundant openings for surgical pilgrimages to the shrines of other worthies. Good is gained by going from the place of original training to another, even if less famous, for all wisdom did not originate, nor will it end, in any particular location. It is well to learn in the beginning that there are "more things in heaven and earth, Horatio, than are dreamt of in thy philosophy," that there are more ways than one of doing the same thing. Some of the most eminent American surgeons now at the less active stage of their careers owe much to early rounds of the operating rooms of the older men who were animated

### HUBERT A. ROYSTER

by the traditions of our forefathers. Peripatetic visiting, engaged in loosely and without purpose, is of no avail. Systematic attendance upon clinics, seeking for light upon some obscure subject, hoping for help where it may be found—these represent legitimate and durable efforts of the honest surgeon. It has always been the custom among those who lead. In his account of the ideal surgeon the mighty Guy de Chauliac provides “that he should have seen others operate.”

The Southern Surgical Association in itself is a tradition. This unique organization, over which by your generous indulgence I have now the honor to preside, was conceived in an unselfish devotion to the faith of the fathers and born in a righteous regard for the highest aims of surgical science. Now nearing its fortieth year of existence, the Association remains true to its original ideals; not for one moment has it departed from the spirit of the principles laid down by its Founders.

What are the factors which have kept us true to our origin, that have knit us closely together and still set us apart from all other similar societies? I love to believe that it is because we are a guild whose brothers are bound in a common purpose to relieve suffering, to put away death, to grow in scientific grace, to add to the world's weal. We have stood for these things, and we will stand for them to the end. I am persuaded, also, that exploitation has never entered our threshold, and that no low or unselfish interest whatever has guided our thought. Can more be said? Yes, this: Paramount and pre-eminent in the very warp and woof of this Association is an inherited tradition, gathered in the souls of the Founders, gaining momentum through the decades and going on to its flower in the lives of us all. That tradition is not visible on the printed pages of the constitution and the by-laws; neither can it be discovered in rules, resolutions or reports. It exists in the minds and hearts of the Fellows, comrades in reverence for the right. That tradition is the tie that binds us. It is honorable, it is sacred, it is immortal. Hold fast to that which is good.

## TREATMENT OF INFECTIONS OF THE FACE\*

BY JOHN W. PRICE, JR., M.D.

OF LOUISVILLE, KY.

THE treatment of infections of the nose, upper lip and face, differ from the treatment of other infected areas, on account of the anatomy of these parts. Here there is increased danger of thrombophlebitis, embolism, cavernous sinus-thrombosis, meningitis, septicæmia and pyæmia.

From these infections bacteria readily enter the facial veins which have no valves; from the facial vein the bacteria may pass into the ophthalmic vein and so to the cavernous sinus, Treves<sup>1</sup>; or, via the pterygoid venous plexus to the cavernous sinus, Taylor<sup>2</sup>; or, the bacteria may pass from the facial vein to the external jugular.

In a very excellent paper on this subject Martin<sup>3</sup> shows that the serious nature of these lesions was recognized seventy-four years ago. Later autopsies on patients dying with facial infections, showed thrombophlebitis of the facial and jugular veins, thrombosis of the cavernous sinus, septicæmia, pyæmia and lung abscess.

Sir William Wheeler has reviewed this subject recently in an editorial in the October number of *Surgery, Gynecology and Obstetrics*, and mentions four fatal cases.

In the past ten years there have been published at least eight articles on the subject. Kahn<sup>4</sup> reports three fatal cases of lip infections, which were in a hopeless condition at the time he first saw them.

Martin<sup>3</sup> reports seven cases who had widespread general infection, or cavernous sinus-thrombosis complicating infections of the face, when they came under observation. The striking thing in the histories of Martin's cases is that all of these patients had picked or squeezed a pimple, or had had one opened by the family physician. These seven patients were admitted to St. Luke's Hospital, New York, during the period between July 17, 1911 and January 8, 1922. All were operated upon at once by multiple incisions under anaesthesia, and six died.

The late Dr. J. William White was ever fond of saying "My friend, Sir Frederick Treves, says so and so," and years later I remembered his saying that Sir Frederick Treves said, "Infections of the lips should not be cut in the early stages on account of the danger of facial vein infection and thrombosis." This advice of Treves has been overlooked in the past by many physicians.

In the summer of 1917, a friend had a pimple in the nose. On Saturday morning he went to see a well-known specialist who opened the pimple. On the following Tuesday morning he died.

\* Read before the Southern Surgical Association, December 16, 1926.

JOHN W. PRICE, JR.

At this time, the late Dr. W. O. Roberts remarked to me that he had never known a patient who had a pimple on the nose, lips or upper part of the face to recover, if the pimple were cut.

The following case, however, illustrates that such a patient may recover:

In the Fall of 1917, while in charge of a surgical service in the Base Hospital at Camp Taylor, I was asked to see in consultation, a captain who had had a pimple in his nose incised by a Nose and Throat Specialist.

The infection began in a hair follicle inside of the left nostril. The nose became greatly swollen and oedematous. The specialist opened the pustule on the inside. Thirty-six hours later, when he came under my observation, the nose and entire side of the face and eyelids were swollen and oedematous; the nose was hard, infiltrated, and covered by glazed, purplish-red, skin. In the centre of the left side, at the level of the nasal bone, there was a small necrotic point filled with a gray slough, and two or three other places which were pointing. Temperature was 101. This patient was treated by the method to be described later, and recovered. I might mention that when suppuration ceased the skin defect on the side of the nose was one inch by one-half inch. At the end of three weeks he had a lineal scar. Fortunately, these severe infections are rare.

The next case to impress me, was a young married woman who opened a pustule, or pimple, on the upper part of her face. Great swelling and oedema soon occurred; she called in consultation a local physician of her home town. He made an incision in the face and in eight days from the appearance of the pustule she was dead.

CASE III was a boy, B. O., six year old, who had a carbuncle of the cheek. He recovered in ten days.

CASE IV was a man, P. B., a lawyer, fifty-two years old, who injured himself on the cheek while shaving on a train. A carbuncle developed and he recovered in ten days.

CASE V was the same patient, who two months later injured his upper lip while shaving on a train. A carbuncle developed and he recovered in two weeks. In this case the skin of the lips surrounding the infected area, had been protected from the wet dressings by a coating of zinc oxide ointment. When the lesion had entirely healed the zinc oxide ointment was removed with gasoline, and the lip further cleaned with alcohol. During the cleaning process the patient complained of the alcohol burning him. Fifteen hours later he had a number of pustules about hair follicles of the upper lip. Within twenty-four hours there was a pustule about practically every hair follicle of his upper lip. The swelling and oedema of the lip was tremendous. By actual measurement it was four and one-half inches long and one and one-half inches wide, so that it overhung the lower lip.

Within the next twenty-four hours the oedema had invaded the entire face, and submaxillary regions. The tenderness and brawniness, however, was confined to the lip. During this stage the entire lip had been painted with 2 per cent. solution of mercuro-chrome, and 4 per cent. saline compresses were kept on the lip constantly. The heads were lifted off of the pustules to facilitate drainage. I seriously questioned the advisability of continuing the conservative measures. The question arose, were the conservative measures really conservative? Was not the risk of a septicæmia greater than it would be if free incisions were made into the lip? Fearing that my judgment might be prejudiced I called in consultation, Dr. Irvin Abell, who agreed that we could at least postpone the dangerous incisions, as the man was holding his own at the present time.

After three days we had localization of the infection in three points; at each point the number of openings varied from four to six. At these points true carbuncles developed. As the process of liquefaction developed the connecting skin between two openings was divided. By this method from day to day, connecting two nearby openings, always towards the centre and always staying within the zone of infiltration, drainage was improved, the sloughs were discharged, and at the end of ten days almost all of the oedema of the face and neck had disappeared. Only the lip was swollen. At this point

## TREATMENT OF INFECTIONS OF THE FACE

the nurse allowed the dressings to get dry and within ten hours the lip was again swollen to twice its normal size. From then on, however, no accidents occurred and the patient made a complete recovery.

**CASE VI.**—October, 1926, Mrs. J. P. E., had a pustule on the lower lip. The infection spread and at the time I was called in consultation there was drainage from five openings. Four openings on the outside and one opening on the inside. There was tremendous œdema of the face and neck. The same treatment was used as is described below. The patient recovered in seventeen days. The external scar is lineal.

*Treatment.*—The treatment of infections of the nose, upper lip and upper part of the face may be outlined according to the degree of the infection.

The infected process may be seen in three stages. First, the initial lesion; second, the period of extension; and third, the period of thrombo-phlebitis, embolism and septicæmia.

*The First Stage.*—The initial lesion is usually confined to a hair follicle, sebaceous gland or sweat gland. It appears circumscribed and superficial. The skin is red, slightly swollen, œdematosus, hard and tender for twenty-four hours. During the following day a central point, the size of a pin-head, becomes necrotic and appears yellow beneath the epithelium.

The treatment of this stage consists largely of "don'ts." Don't squeeze; don't pick; don't cut. One should carry a bottle of alcohol in his pocket and apply the alcohol to the infected areas every hour, or a drop of mercuro-chrome may be applied two or three times a day. After another twenty-four hours the process is definitely localized in most cases. The necrotic area may be opened with safety. Alcohol or mercurochrome may be applied, and resolution occurs.

*The Second Stage.*—The second stage, the period of extension, develops when localization fails to occur, or as is usually the case, after the infected area has attracted the patient's attention, and either he or his family physician squeeze, pick or cut into it. Within twenty-four hours the infection invades the neighboring hair follicles and glands. A carbuncle is developing. A wide area of surrounding tissue is swollen, œdematosus, infiltrated. Pain is intense. If a lip is involved it becomes two or three times its normal size. The skin is purplish red. About the central necrotic focus, the tissues are very hard and tender. If it has been opened there is almost no discharge. A small gray slough is visible. It seems to the writer that it is this condition which has led so many physicians into using a knife at once, and on finding no free pus to squeeze the tissues or to probe them. The early incision, squeezing and probing, not only fails to give relief but causes a further rapid spreading of the infection, and frequently results in a fatal thrombophlebitis of the facial vein, or septicæmia.

The treatment of the second stage is as follows:

*Constitutional.*—The patient's powers of resistance should be reinforced by feeding. The local measures will insure rest, sleep, drainage and freedom from pain.

The local treatment is divided into two stages. During the first few days the one or more necrotic points are kept open, and compresses saturated in

JOHN W. PRICE, JR.

4 per cent. salt solution, are applied every hour and kept constantly wet day and night by fresh salt solution being added to the gauze with a dropper every fifteen minutes. (The gauze is so small that it tends to dry in this time. Large gauze compresses are to be avoided because their weight interferes with the superficial circulation and also because large compresses are painful.)

The second stage of the treatment begins when the process has become localized and the process of liquification has advanced. This stage is recognized by a more abundant discharge. Now is the time when small multiple incisions may be made to connect the multiple openings toward the centre. Small bits of gauze are inserted to keep the skin edges apart, and to maintain drainage. The compresses are continued as before until healing has occurred.

By this method of *delayed operative interference* we confine our incisions to the walled-off zone, and we avoid cutting into veins which are not blocked, and lessen the chief danger of a carbuncle of the nose, upper lip, or upper part of the face, namely, septicæmia or a thrombophlebitis and embolism of the facial vein.

*The Third Stage.*—If the patient is seen for the first time in the third stage of the process, with thrombosis of the cavernous sinus, meningitis or septicæmia, the case is, in all probability, hopeless. Nothing will be gained by multiple incisions, as illustrated by the case reports of Martin and Kahn.

If there is no cavernous sinus-thrombosis, but a septicæmia is present, the same local measures as described for Stage 2 should be applied, and the usual methods for combating a septicæmia instituted. Intravenous injections of gentian violet and mercurochrome have been suggested.

REFERENCES

- <sup>1</sup> Treves, F.: System of Surgery, vol. ii, 1896.
- <sup>2</sup> Taylor, E. H.: Applied Anatomy, 1904.
- <sup>3</sup> Martin, W.: ANNALS OF SURGERY, July, 1922, vol. lxxvi, p. 13.
- <sup>4</sup> Kahn, M.: Journal Am. Med. Assn., March 29, 1924, p. 1043.

## EXPERIENCES WITH THE THYROID PROBLEM IN A DETROIT CLINIC\*

BY ROY D. McCCLURE, M.D.  
OF DETROIT, MICH.

FROM THE SURGICAL DEPARTMENT OF THE HENRY FORD HOSPITAL

FOR the year 1915, there are listed in the *Index Medicus*, 175 papers on the thyroid gland and its diseases. In 1920, there are 215 such papers listed, while in 1925, there are 510. One real discovery had just been made, and that was the discovery and isolation of thyroxin by Kendall (1914). Some refinements in operating technic have been reported but nothing of great moment. Definite progress has been made in the study of the metabolism of goitre patients, and this knowledge has been so thoroughly spread that there are few surgeons who care to operate on a sick thyroid patient without first having metabolism studies, which help so much in the judgment as to the proper time to operate. The revival of the use of iodin in the treatment of goitre—a treatment as old as the history of medicine—has added much to the success of the operative treatment of Graves' disease as well as in diminishing greatly the amount of colloid goitre. It not only aids in the prevention, but serves in the actual treatment of colloid goitre.

These thousands of papers on the subject of goitre in one decade are mostly concerning one new scientific discovery, refinements of operative technic, metabolism, anaesthesia, classifications—clinical and pathological—together with personal experiences of the authors. This literature is increasing with such an accelerating curve, that at this rate there will be produced within a short time a hundred papers a month on this subject. This is rather appalling to those who must cover the literature. Since the theoretically ideal state of a clearing house for knowledge, in which only papers with new facts would be worthy of publication, is not yet attained and might not perhaps be desirable, we find excuse for presenting to you this brief discussion of some of our experiences and to set before you a plea for earlier operation in the great group of adenomas of the thyroid.

Surgery has reached the stage where everything is done to save the small percentage of patients. We know that the great percentage of patients with appendicitis get over an attack without operation. Early operation is advised to save that small percentage who get peritonitis and die. After careful survey of the reported deaths, with or without operation, we believe that all patients who have adenomas of the thyroid should be advised to have such adenomas excised. We have come to this conclusion because the statistical studies from the various clinics, as well as our own results, show that the toxic adenoma cases are responsible for more than twice as many deaths as is exophthalmic goitre. Not only is the adenoma a menace on account of its potential toxicity, but it may also be regarded as a precancerous lesion.

\* Read before the Southern Surgical Association, December 15, 1926.

ROY D. McCLURE

Carcinoma of the thyroid is far from being a negligible disease, and it usually arises in an adenoma. Precancerous lesions elsewhere in the body are regularly removed.

An early operation for adenoma or adenomata of the thyroid without symptoms or with very few symptoms should be as near danger-free as is any surgery. Its potential good is enormous. By some this is and will be regarded as a radical surgical idea, but by those of us seeing large numbers of patients with toxic thyroid adenomata, many of whom die needlessly early deaths, the idea is known to deserve serious consideration and discussion, just as did the idea of early operation for appendicitis. Even though a patient very ill with toxic adenoma comes successfully through the operative procedure, she or he has suffered irreparable damage to the heart muscle and undoubtedly has a diminished life expectancy.

Just at this point it might be well to give our experience concerning the use of iodin in the prevention of goitre.

About three years ago in Michigan there was a good deal of public propaganda about the prevention of goitre by the administration of iodin. In our clinic for some time before this, we had been using sodium iodid in the treatment of adolescent goitre and several hundred children, mostly females, were treated by us over a period of some years by the administration of sodium iodid in small doses for a period of three weeks, twice each year. The result of treatment by this method is most satisfactory and in practically all cases the goitre diminished greatly in size and has not since caused trouble. In a few cases we had acute iodin reaction in the thyroid, which, however, in a short time subsided.

In Michigan, the salt manufacturers put out table salt containing iodin. This has been introduced to the community through the grocers so that iodin table salt is in general use in Detroit. It was thought that in this way everyone would make up for the deficiency in our region in iodin intake. This is a rather uncertain method, however. Many people do not like salt in their foods and do not use salt as a condiment at the table, and even go so far as to insist on salt-free butter. One patient that I have with this idiosyncrasy against salt now has a colloid goitre. So it is seen that this method is not sufficient, as many of the population do not get iodin by this method.

Now the statistics which I am giving seem fairly conclusive in condemning this method of the distribution of iodin. It is known that an over-use of iodin results in activating adenomas of the thyroid and that it can produce an acute toxic condition. It is very probable that for this reason the use of iodin generally in the treatment of goitre fell into such disrepute with some of the leading medical men of the latter part of last century and the first part of this one. These statistics, obtained from our Health Department in Detroit, are most striking and suggestive.

The general use of table salt with iodin began in the latter part of 1924. The death rate in Detroit, as registered in the Health Department in the year 1916 showed the total number of goitre deaths as 17—a death rate of

## THE THYROID PROBLEM IN A DETROIT CLINIC

2.44 per 100,000. The following year the death rate was 4.32; then the successive years it was 2.45, 3.99, 2.74, 3.07, 4.63, 3.71, with 4.16 in 1924. It was in this year that the general use of table salt with iodin was begun. The deaths from goitre in 1924, in Detroit, were 47, with a death rate of 4.16. In the next year, after this treatment had become generally used, the deaths showed a jump from 47 to 76, with a death rate of 6.1, and in 1926, which are completed up until the first of December and estimated for this month, they jump to 122 deaths with a death rate of 9.4. This may be a most distinct and perhaps alarming result of the general use of iodin without control. The only other possible explanation is that the physicians are as a result of this propaganda, using iodin injudiciously in the treatment of toxic adenoma and exophthalmic goitre. It is interesting to note that these deaths are divided in our Health Department as toxic goitre and simple goitre. The number of toxic goitres as shown by these statistics shows a change. The deaths in toxic goitres have increased in percentage from 2.26 to 8.5 per 100,000, whereas the simple goitre rate has decreased from 1.22 to 0.9. These statistics are most distinct in suggesting that the free use of iodin table salt should be discontinued, but I believe the controlled iodin dosage should be again substituted, for there is no doubt of its beneficial effect if used in this way.

We also use iodin in preparing our toxic goitre patients for operation. It is of the greatest value in reducing the time necessary for rest before operation, in both the exophthalmic cases and the toxic adenomata if they have not previously been treated with iodin, a practice which should be condemned. Our experience does not agree with some who advise against the use of iodin as a pre-operative measure in the toxic adenoma cases.

The simple or colloid goitres came to operation only on account of trachial pressure, stretching of recurrent laryngeal nerves, or for cosmetic reasons.

The adenoma group have been operated on for the above reasons occasionally, but usually on account of toxic symptoms, *i.e.*, they showed definite signs of hyperthyroidism. The exophthalmic patients were operated on in practically every instance. The operation followed is that introduced and described by Dr. W. S. Halsted. In a good percentage of the cases a multiple stage operation was done. The usual anaesthetic used is ethylene gas. In an experience of over 600 goitre anaesthesias with ethylene, we conclude that it is well tolerated and that it exerts no stimulating or depressing influence on the heart.

A number of the patients operated on had previously been treated by Röntgen-ray or radium with some improvement, but with unsatisfactory results, not approximating in any way the results which we see in patients of a similar long-standing stage of development of the disease treated by operative measures.

Over 86,000 patients have had physical examinations in our clinic. These patients belong mostly to the private patient class. To determine the prevalence of goitre or its symptoms in such a group regardless of the complaint or diagnosis, we have made a survey of the first 50,000 patients. This is being

ROY D. MCCLURE

done by having a goitre card (see sample) for each patient. The different items as found positive are registered by punching. To get the cards of patients positive for any desired fact these cards are run through the sorting machine at the rate of 12,000 per hour. We will not bore you with many of these statistics now.

In the first 50,000 we had had 3092 patients with some enlargement of the thyroid, noted in the history. Of these 2564 were women, 528 were men—a ratio of about 5 to 1. The non-operative cases included in the above figures total 2667. Of these 2189 were women and 476 were men—a ratio here of about 4 to 1. The operative cases totaled 424, of which 375 were women and 49 were men—a ratio of nearly 9 to 1.

Of 17,250 patients coming to the clinic during the year 1925, 211 had operation for goitre—(a) simple or colloid, 23; (b) adenoma of all types, 101; (c) exophthalmic or hyperplastic, 79. Of this number 62 per cent. only complained of goitre. We will to-day analyze only the work of this one year. Of these 211 operated cases, 55 per cent. have been regarded as severely toxic and correspondingly grave operative risks; 30 per cent. have been less toxic and 15 per cent. had few or no symptoms of hyperthyroidism. Of the 118 very toxic cases, 55 per cent. showed purely parenchymatous hypertrophy and hyperplasia; 31.5 per cent. were adenomata; 4.2 per cent. showed adenomata and hyperplasia; 8.5 per cent. were colloid goitres and there was one case of tuberculosis of the thyroid. The 62 mildly toxic and the 31 non-toxic cases showed different percentages. Pure parenchymatous hypertrophy and hyperplasia was present in only 21 per cent., while 66.5 per cent. were adenomata; 11 per cent. were mixed adenoma and hyperplasia; 1 per cent. was colloid and 1 per cent. was normal thyroid. Of the 31 non-toxic cases 3.2 per cent. showed pure hyperplasia and hypertrophy; 74 per cent. were adenomata; 3.2 per cent. mixed adenoma and hyperplasia; with a showing of 19.5 per cent. of colloid goitres.

About one-third of these patients did not complain of goitre or were unaware that they had an enlarged thyroid. Of the patients on whom we operated, 80 per cent. had toxic goitres and three of every four of these were grave surgical problems on account of severely toxic symptoms. A patient is never scheduled for operation until there is agreement between the cardiologist and the surgeon, and if there is present hyperglycaemia or diabetes—between the surgeon, cardiologist and our metabolism division head. Often, too, the neuropsychiatrist must pass on the probable benefits before operation. Our routine basal metabolic studies are made on all patients by the gasometer method of Tissot with gas analysis, as modified by Boothby and Sandiford. The usual twelve to fourteen-hour resting and fasting is demanded of the patient, and for a period of twenty to thirty minutes preceding the test he is also required to remain in complete relaxation in bed. Repeated observations of respiratory and pulse rate are made. The mask or mouthpiece is now adjusted and the expired air is collected in the gasometer for a period of at least five, but not more than ten minutes. Repeat examinations are

## THE THYROID PROBLEM IN A DETROIT CLINIC

preferred and these are done on succeeding days rather than during the same day. It is often necessary to discard entirely the results of the first examination because of the apprehension of the patient and lack of complete coöperation. Part of the total volume of expired air is analyzed on the Haldane gas analysis apparatus, determining the percentage of carbon dioxid produced and oxygen absorbed. With the volume of air expired, the CO<sub>2</sub> produced, and oxygen absorbed, calculation of the basal metabolic rate is made, using the standards of DuBois.

The usual history of definite nervousness, palpitation, insomnia, irritability, loss of weight, fatigueability, with clinical symptoms of tremor, tachycardia, restlessness, flushing, etc., and with an increased basal metabolic rate—are all considered in evaluating the case. Palpation of the thyroid is of most importance in differentiating between adenoma and hyperplasia and even this is not always positive in making the diagnosis. It is remarkable if there are two separate diseases with symptoms so identical and equally variable.

A noteworthy difference recently in reports by various surgeons is that there are more deaths following operation on toxic adenomatous goitres than on the hyperplasias. This indicates to me only that there has been the long drawn-out intoxication, with the adenomatous group with great visceral degeneration due to this fact, and not to any essential difference in the disease process itself.

It is accepted by many that true hyperplasia or exophthalmic goitre is a disease—extrinsic to the thyroid—while adenomatous goitre with hyperthyroidism is intrinsic. With symptoms so nearly the same and with so much overlapping that the true diagnosis can be arrived at not from signs and symptoms, but from the history of duration and by pathologic examination of the thyroid, it must be that the above theory, that the one is intrinsic while the other is extrinsic, is not yet proven in spite of its wide acceptance. Whartin believes that both the adenomas and hyperplasias are part of a constitutional condition—*status thymolymphaticus*.

In our clinic, studies by our cardiologists show that in the severest heart conditions with auricular fibrillation present (in 100 such cases studied), 73 per cent. were in adenoma cases and 27 per cent. were in hyperplasia cases.

Some patients are considered entirely too ill to be operated on, and some in our clinic die without operation. We have deliberately operated on a few of these patients after thorough pre-operative preparation, patients whom we felt were surely going to die, and occasionally have had a most agreeable surprise in seeing a rapid improvement in the patient's condition. With everything possible done for these patients, care must be taken *not to have too much concern over our mortality statistics*, for an occasional patient may be lost who might have had his life prolonged by operation.

We do not feel that auricular fibrillation is a contra-indication to operation. In a recent group of thyroids studied by our cardiologist, twenty-two patients with fibrillating hearts were operated on with one death, and this death came later following a second stage operation. There was a group of eight with

ROY D. McCLURE

fibrillation in hyperthyroidism who were treated medically. Four were admitted in extremis and soon died. The other four refused operation and continued to fibrillate in spite of measures of cardiac protection and digitalis medication.

Without operation these patients have very little to hope for beyond a few months or years of chronic invalidism. Of this group 41 per cent. resumed a normal rhythm spontaneously. The average number of days before this occurred was twenty-five. Dr. Janney Smith, our cardiologist, concludes that auricular fibrillation occurring in hyperthyroid patients is caused, or strongly contributed to, by a toxic factor, which gradually clears up after operation, allowing the normal sinus rhythm to become reestablished in almost half of the cases.

CONCLUSIONS

1. The use of iodin promiscuously in table salt in the effort to prevent simple goitre may be harmful.
2. The use of iodin controlled by regular dosage is of great value in the prevention or treatment of simple colloid goitre.
3. The use of iodin in the preparation of patients with hyperplasia of the thyroid for operation is of great value.
4. The use of iodin in the preparation of patients with toxic adenoma for operation has been of value in our clinic.
5. We advocate the removal of simple adenomas of the thyroid as a potential source of toxic hyperthyroidism, as well as for the fact that an adenoma may be a precancerous lesion.
6. Myocarditis with auricular fibrillation is not a contra-indication to operation.
7. Too much concern over mortality statistics may cost the life of an occasional patient who might, with operation, have had his life prolonged.

## THYROIDITIS ACCOMPANIED BY HYPERTHYROIDISM\*

BY ADDISON G. BRENIZER, M.D.

OF CHARLOTTE, N. C.

I AM not to discuss so-called toxic thyroiditis, nor suggest more than the possibility of such an entity accompanying the syndrome of Graves' disease. The pathological picture of the thyroid in a certain percentage of exophthalmic goitre cases is not dissimilar except in degree to that following the actual invasion of the thyroid by bacteria, with the accompanying inflammatory and hypertrophic and hyperplastic changes. Although no bacterial invasion can be demonstrated in the overwhelming majority of hyperplastic thyroids, the general theory of etiology through bacteria or their products is most interesting in considering a disease where the causes are almost entirely unknown. Many of these cases may be merely an expression of lymphatism.

Various investigators, notably Roger and Garnier,<sup>1</sup> Shimodaira<sup>2</sup> and others have, as far back as 1900, injected various bacteria into the blood stream and recovered them, respectively, in the thyroid gland. Tomellini,<sup>3</sup> in 1905, drew the following conclusions, quoted by Mosimon<sup>6</sup>:

(a) "The thyroid can become infected with experimental tuberculosis by direct injection of small masses of tubercle bacilli, just as other organs—the spleen, kidneys and testicles can become infected."

(b) "The susceptibility of the thyroid against tuberculous infection is less than in the other named organs."

(c) "The decreased susceptibility of the thyroid against tuberculous infection is probably united with the special functional activity of the gland."

The above quoted experiment would go to prove the possibility of a bacterial invasion of the thyroid, by way of the *blood route*. The reported cases, for example, cases one and two of my series, strongly indicate direct bacterial invasion by *contact* and possibly by the *lymphatic route*.

Riedel reported what he called iron-hard struma, in 1896. So-called primary tuberculosis of the thyroid gland was not reported before 1890. Voorhees, in 1914, reported a case of thyroiditis and remarked that, although there were several reported in German and French literature, the condition was not mentioned in any English text-book.

Mosimon's,<sup>6</sup> in 1917, is the first comprehensive report I have been able to find on tuberculous thyroiditis and the first to point out a striking relationship between tuberculous thyroiditis and hyperthyroidism. Out of 9 cases reported, 5 cases, which had been previously diagnosed exophthalmic goitre, also showed hyperplasia; in 2 cases diagnosed mild or questionable exophthalmic goitre, were found hyperplastic areas. These 9 cases comprised less than one per cent. of the operative material removed at the Crile Clinic at that time.

\* Read before the Southern Surgical Association, December 16, 1926.

ADDISON G. BRENZER

Plummer and Broders,<sup>7</sup> in 1919, reported 7 cases of tuberculosis of the thyroid gland, of which 5 cases could certainly be diagnosed hyperthyroidism and pathologically 6 of these cases showed hyperplasia. The greater the tuberculous involvement, the less severe the toxic symptoms and this fact was explained by the more extensive destruction of the gland. In 2 of the 5 patients with definite hyperthyroidism, the goitre was noticed before the symptoms; in 2 the opposite was true and in one, no thyroid enlargement had been detected. In the same article, Plummer remarks that chronic simple thyroiditis may give the same thyroid signs, but in the experience of the Mayo Clinic, it has not been associated with hyperthyroidism. Likewise, Judd,<sup>8</sup> two years later, in 1921, observed that simple thyroiditis may show symptoms of hyperthyroidism, to later disappear in the progress of the disease (destruction of thyroid elements).



FIG. 1.—Case I. Abscess of thyroid gland before rupture into trachea.

plus 26). The pathologic picture showed diffuse fibrosis and round-cell infiltration into apparently normal thyroid tissue. There were no hyperplastic areas found at a later date when the gland was studied. There was nothing to justify a suspicion of tuberculosis, syphilis or malignancy.

Up to July, 1924, according to St. George,<sup>10</sup> reporting 3 cases under the heading of chronic productive thyroiditis (Riedel's iron-hard struma, benign granuloma of the thyroid (Ewing), or ligneous thyroiditis (Delore), the condition is referred to in only one English text-book, the case of Bohan, one by Bruno Setitscheck and one or two references to French writers. Hashimoto, in 1912, reported several cases in which there was marked round-cell infiltration. Ewing has seen four of these cases. Crile has encountered 13 well-defined examples. At the Mayo Clinic 48 cases were found among 10,500 thyroidectomies. A progressive hyperthyroidism was not found to accompany this entity as described by Riedel and the pathological picture was usually a fibrosis replacement of the thyroid elements and round-cell infiltration. The condition is a chronic inflammatory process and it is quite

## THYROIDITIS ACCCOMPANIED BY HYPERTHYROIDISM

conceivable that the same agent which irritates the cells to hyperfunction or dysfunction may, when it acts for a longer time, paralyze cell function.

Searls and Bartlett,<sup>11</sup> May, 1926, group simple, non-specific thyroiditis into acute, subacute and chronic types and affirm that exophthalmic goitre may accompany all types. These two authors analyze a series of 17 cases and 20 cases, respectively, pointing out a contrast between the typical pathological picture of exophthalmic goitre and chronic non-specific thyroiditis with hyperplasia. In exophthalmic goitre, cells of the lymphatic series, grouped in the follicles or scattered between the acini are a part of the pathological picture (lymphatism); in chronic thyroiditis with hyperplasia, an advanced infiltration associated with desquamation and fibrosis gives a picture sometimes so dominating as to obscure an accompanying hyperplasia.

The question again comes up, as intimated in the first paragraph of this paper, as to the old discussion of thyroiditis and exophthalmic goitre or a hyperplastic gland with more or less lymphatism and accompanying degenerative changes in the thyroid elements.

Last February, 1926, Watkins,<sup>12</sup> in a very scholarly paper, emphasizes the fact that the thyroiditis referred to in the older literature and assigned an importance in the various pathological states of the gland, such as exophthalmic goitre, come about through the assumption that the localized collections of lymphocytes with or without the development of germ centres, were evidences of inflammation, whereas, at the present time, these findings are looked upon merely as a part of thymico-lymphatic constitution, which these cases all show to a more or less degree.

A bacterial cause has been proven only in suppurative lesions and in such chronic processes as tuberculosis and syphilis. With the exception of woody or ligneous thyroiditis, milder inflammatory processes and even the cases of tuberculosis have not been demonstrated prior to pathological examination. In woody thyroiditis, bacterial cultures have not been recovered from the gland. The streptococcus and staphylococcus in Bohan's case of ligneous thyroiditis were cultivated from the teeth roots.

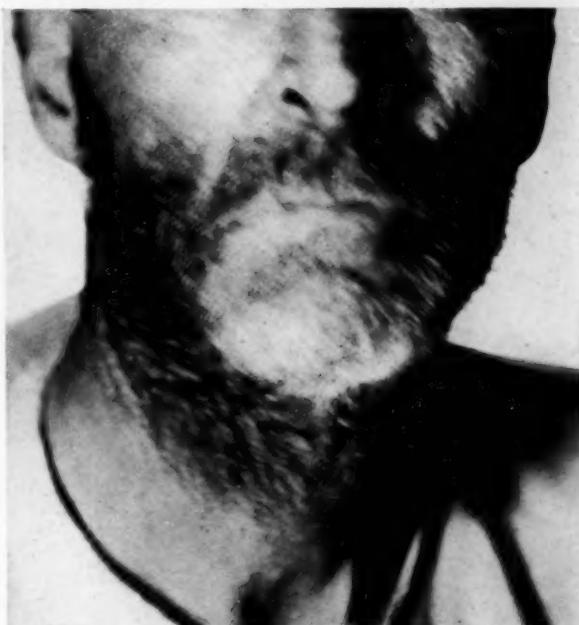


FIG. 2.—Case I. Abscess of thyroid gland after rupture into trachea.

ADDISON G. BRENZER

Davis<sup>13</sup> reports seventeen recorded instances of gumma of the thyroid and points out a description of a diffuse thyroiditis syphilitica which is exceedingly rare. Two of my cases to be reported are of this later type, accompanied by exaggerated symptoms of exophthalmic goitre.

One might conclude with Plummer that "either a hypertrophic gland is rendered more susceptible to invasion by bacteria or the infection stimulates the parenchyma to an abnormal activity, and is thus inherently responsible

for the hyperthyroidism with its attendant symptoms."

In a personal communication by letter with Harry G. Sloan, of the Crile Clinic, he writes me in part as follows:

"We have learned to associate an infection in the pharynx, which we have found invariably to precede acute thyroiditis, and invariably find, when the thyroid is involved in an acute inflammation, that the patient gets a thyroid intoxication quite similar to that seen in Graves' disease."

"This acute thyroiditis not infrequently goes on to suppuration and within the last four years, I have had two typhoid abscesses from which we removed the organism; as well as four pyogenic ones where staphylococcus was found. The condition may subside with abscess formation, and then again we see the more



FIG. 3.—Case II. Thyroiditis and cervical adenitis with first hyperthyroidism then myxedema and ptosis.

chronic type, merging into woody or ligneous thyroiditis, where the gland is as hard as cartilage and on exposure looks like cartilage—this may involve only one area of the gland or the entire gland. We do not ordinarily operate on ligneous thyroiditis if we can disprove its malignancy, with which it is so nearly to be confounded. The microscopic sections of it look as though every cell had been destroyed, yet we invariably find they make a full recovery, if let alone, without developing any signs of subsequent myxedema."

Pemberton, of the Mayo Clinic, writes me, October 25, 1926:

"Inflammatory processes in the thyroid occur as the result of tuberculous and also non-tuberculous infections. In all the tuberculous cases which have come to operation, I have never seen more than seven or eight associated with hyperthyroidism; some of these were definitely associated with exophthalmic goitre. In the non-tuberculous variety

## THYROIDITIS ACCOMPANIED BY HYPERTHYROIDISM

there is often a history of preceding infection, usually in the tonsils, followed by pain and swelling in the region of the thyroid gland, although it is not uncommon to find painless swelling in any of these cases, without any preceding history of infection."

"In most instances we see thyroiditis in the chronic state, showing at operation the woody type of inflammatory reaction; at the time of examination this is usually unassociated with hyperthyroidism. In many cases of thyroiditis of the acute or subacute variety there is a definite increase in the basal metabolic rate, and many of these have been diagnosed exophthalmic goitre. My impression is that in a very high percentage of instances they go on to the development of myxoedema, presumably whether or not they are operated upon."

"In the above discussion, I have not included the cases of thyroiditis which are associated with exophthalmic goitre, for in about 10 per cent. of all these cases the histologic section of the slides shows a picture of round-cell infiltration and fibrosis in a degree sufficient to diagnose thyroiditis. In most instances these are of a mild degree, but not infrequently it is marked, and in about one-half of 1 per cent. of the cases it is very marked. These patients invariably develop myxoedema."

"At this time we have under observation one of our own nurses who, following a throat infection developed painful swelling in the neck. Her metabolism went up as high as plus 30. Since then (two months) the swelling has entirely subsided and her metabolism is normal. Subsidence of the inflammatory process in the gland and of the febrile reaction came about very rapidly following tonsillectomy."

### CASE REPORTS

CASE I.—Man, fifty-two, in good health up to time he developed influenza with bronchitis and cough for a week. Cough more irritating and mass appearing over front of neck below thyroid cartilage, moving up and down on swallowing, which was done with difficulty. The mass became larger, more sensitive and presented in the shape of the two lobes and isthmus of the thyroid gland. At this stage the patient became nervous and tremulous, very weak, fast heart beat over a period of several days. During this time the whole mass gradually softened, fever continued but patient was much relieved of tachycardia, tremor and weakness. Incision of mass was advised and refused because he felt so much better. Mass finally ruptured into the trachea and abundant pus was



FIG. 4.—Case III. Exophthalmic goitre, tuberculous thyroiditis, after operation.

ADDISON G. BRENZER

coughed up, leaving the region of the neck almost flat. The patient was sluggish and inert for several weeks but finally reached his equilibrium, gained considerable weight and felt perfectly well again. This case was observed in 1912.

(In 1921, Gilman reported a similar case in which liquefaction involved the entire gland, including the isthmus, leaving only a shell of gland tissue within the capsule.) Figures 1 and 2 show the man photographed before and after rupture of the abscess into the trachea.

CASE II.—An unmarried woman, twenty-eight years old, previously in splendid health, except for occasional attacks of tonsillitis, was taken with a severe infection of tonsils and throat; the lymph glands, particularly on the left side of the neck, were enlarged, massed and very tender. Then appeared an enlargement over the lower front of neck. Almost overnight her eyes began to protrude markedly, her pulse became very rapid. The eyes protruded almost beyond the lids. She became too weak and nervous to rise out of bed. Her fever gradually subsided, her throat recovered, her tonsils were removed and finally and rapidly both lymph gland masses and the swelling over front of neck subsided, the eye balls retired in their protrusion and the much lengthened and thickened lids dropped in ptosis over them. Evidently the cervical sympathetic had been injured. The patient went rapidly into myxedema and was only recovered by the use of thyroid extract for several months.

A plastic operation was done



FIG. 5.—Case V. Exophthalmic goitre, osteomyelitis. Syphilis.  
After-treatment.

for the partial support of her eye lids. Figure 3 is a very poor photograph of her two months later.

CASE III.—A married woman aged fifty, noticed the presence of goitre for two years, which had gradually increased in size. During the course of the last year her pulse has been very rapid, her eyes have become very prominent, loss of thirty or more pounds in weight, very nervous. The patient appeared as a thin woman, marked exophthalmos, general enlargement of thyroid gland somewhat hard, elastic and finely nodular on the surface. Afternoon temperature, 98; pulse, 120; respiration, 20 and blood pressure, 160/70. Marked tremblement and tremor of fingers, metabolism plus 46. After a short course of Lugol's and pulse of 90 all gland was removed under novocaine except a small portion of both upper poles, which appeared to be fairly normal gland. The removed portion was finely granular, very vascular and friable and uniform on the cut surface. The microscopic report was that, throughout, the gland was infiltrated with lymphocytes, minute tubercles and giant cells were found throughout the interstitial tissue. The

## THYROIDITIS ACCOMPANIED BY HYPERTHYROIDISM

follicles were infolded and lined by proliferating columnar epithelium. Diagnosis.—Tuberculosis of Thyroid with Hyperplasia—Exophthalmic Goitre. The improvement in this case has been as revolutionary as any case of exophthalmic goitre. The healing was uneventful except for little discharge of pinkish serum. There has been return of pulse rate to 80, gain of weight, etc., July 15, metabolism was plus 46. December 11, metabolism is plus 24, temperature 98/6, gain of 32 pounds weight. Figure 4 is a photograph of patient at present time.

CASE IV.—An unmarried girl, twenty-three years old, who developed a chancre on the gum after dental work, followed by mucous patches, secondary rash, palpable lymph glands, etc. About three months later was sent in with typical case of exophthalmic goitre. Symptoms of Graves' disease subsided rapidly under antiluetic treatment, tremor, swelling of thyroid disappeared and patient reached stage of good health and stability. She has remained well for eleven years. No metabolic rates were taken in those days.

CASE V.—A widow, fifty-three years old. Osteomyelitis of the skull and left tibia. Typical exophthalmic goitre; positive Wassermann. Under antiluetic treatment symptoms of Graves' disease subsided rapidly. She was likely hyperthyroid for several months.

Sequestra were removed from skull and tibia. Wounds healed and patient remains quite well for fourteen years.

Also one case of tuberculous thyroid and two cases of ligneous thyroiditis without hyperthyroidism. These cases make up about  $\frac{1}{2}$  per cent. of my operative material and about  $\frac{1}{4}$  per cent. of my observed clinical cases.

### CONCLUSIONS

- (a) Thyroiditis is rare, probably  $\frac{1}{2}$  to 1 per cent. of all operative material and  $\frac{1}{4}$  to  $\frac{1}{2}$  per cent. of all observed clinical cases.
- (b) The two most frequent proven types of inflammation are tuberculous and woody thyroiditis. Syphilitic thyroiditis certainly occurs. Non-specific thyroiditis has shown its bacterial cause in some suppurating cases.
- (c) Hyperthyroidism may accompany any type of thyroiditis at any stage; usually the subacute stage. The relation in tuberculous thyroiditis is striking.
- (d) Most cases of non-specific and woody thyroiditis finally become hypo-thyroid whether operated on or not. (Difference of opinion as to this point at the Crile and Mayo Clinics.)
- (e) Cases of tuberculous thyroiditis operated on have given the best functional lasting results. Syphilitic thyroiditis has been relieved with appropriate treatment.
- (f) Therefore the more slowly progressive and destructive type of inflammation is more apt to be accompanied pathologically by hyperplasia and signs of hyperthyroidism and is more apt to give better functional results after operation.
- (g) The usual amount of thyroid should <sup>carefully</sup> not be removed, even in tuberculous thyroiditis, for at least one case out of thirteen has resulted in myxedema.

### REFERENCES

<sup>1</sup> Roger and Garnier: Arch. gen. de Med., 1900, vol. clxxxv.

<sup>2</sup> Shimodaira: Detsche Ztschr. f. Chir., 1911, vol. cix.

<sup>3</sup> Tomellini: Beitr. z. Path. Anat. v. z. allg.—Path., Jena, 1905, vol. xxxvii, p. 590.

ADDISON G. BRENIZER

- <sup>4</sup> Riedel: Verhandl. d. Dtsch. Ges. f. Chir., 1896, vol. xxv, No. 1, p. 101.
- <sup>5</sup> Voorhees: Med. Record, November 21, 1914, vol. lxxxvi, p. 883.
- <sup>6</sup> Mosimon: Surg., Gyn. and Obstet., 1917, vol. xxiv, pp. 680-693.
- <sup>7</sup> Plummer and Broders: Mayo Clinics, 1919, p. 504.
- <sup>8</sup> Judd: Mayo Clinics, 1921.
- <sup>9</sup> Bohan: Med. Clinics of North Amer., vol vii, January, 1924.
- <sup>10</sup> St. George: ANNALS OF SURGERY, July, 1924.
- <sup>11</sup> Searls and Bartlett: Cal. and West. Med., vol. xxiv, May, 1926.
- <sup>12</sup> Watkins: Annals of Clin. Med., vol. iv, No. 8, February, 1926; vol. vii, p. 273.
- <sup>13</sup> Davis: Chicago Path. Society, 1907-1909.
- <sup>14</sup> Sloan: Crile Clinic, Personal Communication, October 7, 1926.
- <sup>15</sup> Pemberton: Mayo Clinic, Personal Communication, October 25, 1926.

## PRIMARY ENDOTHELIOMA OF CERVICAL LYMPH-NODES\*

BY CHARLES W. FLYNN, M.D.  
OF DALLAS, TEXAS.

ALTHOUGH the medical profession generally thinks of primary endothelioma of cervical lymph-nodes as almost a curiosity, because of its rarity, Ewing, as early as 1913, and Jean Oliver since then, have asserted that the disease actually is much more prevalent than is commonly supposed. I personally have recognized it in only one instance, and then by biopsy, and in that case the disease resulted fatally. This one experience has sufficed to convince me that an early diagnosis of the disease (which I now realize would have been possible in that case), followed by a complete extirpation of it surgically while the condition is still local, will reduce fatality. At this time it is possible to recognize the disease only by biopsy, and to do so in that manner requires the services of a highly competent pathologist. Since it is at least possible histologically to differentiate the disease now, it can reasonably be expected that in due course it will become possible clinically to recognize the disease. Accordingly, the little I have by experience learned of the disease I propose to incorporate in this paper, in the hope it will be of service to some one who eventually can develop and publish a clinical picture of the disease.

Before reporting the solitary case that has come under my observation, it is proper briefly to summarize the published data on this subject. In 1869, the term "Endothelioma" was introduced by Golgi. For a long time afterward it was a debated question whether tumors actually originated in endothelium.

In 1880, Chambard described a primary cancer of lymph-nodes originating in endothelial cells, and in consequence he may properly be called the discoverer of primary endothelioma of the lymph-nodes. In his report he described a local form involving one node or one chain, and a generalized form that quickly resulted fatally. Thenceforth, and until 1913, primary endothelioma of the lymph-nodes was simply a medical curiosity having virtually nothing but theoretical interest.

In 1913, Ewing published a monograph entitled "Endothelioma of Lymph-nodes" reporting a series of cases, and with that paper the subject first acquired clinical importance. He somewhat boldly asserted that the disease is a rather common neoplasm, differing histologically, anatomically and even clinically from all other diseases, and especially secondary carcinoma, lymphosarcoma and Hodgkin's disease, which are the diseases with which it is still most often confused.

---

\* Read before the Southern Surgical Association, December 15, 1926.

In consequence of the studies and reports of Ewing, Oliver, and others, we now know definitely that primary endothelioma is actually a distinct disease somewhat frequently arising in the lymph gland structure in the neck, the axilla, and the groin. We know, too, that at its inception and thereafter for a varying length of time it is occasionally a truly local condition admitting of complete cure if it involves accessible glands susceptible to surgical extirpation. We further know that the disease eventually becomes generalized and is then necessarily fatal, and as a consequence, the sooner its existence

is recognized and it is treated, the more favorable will the prognosis be.

Although we have all this theoretical knowledge, its application in practice is one of the most difficult tasks confronting the surgeon. Primary endothelioma of cervical lymph-nodes has been, and can be, definitely differentiated. However, in many respects its manifestations are closely similar to those in other diseases, notably in acute infectious adenitis, tuberculosis, syphilis secondary lymphosarcoma, and Hodgkin's disease, and clearly to differentiate it from them all requires painstaking collaboration of diagnostician, pathologist, and surgeon.

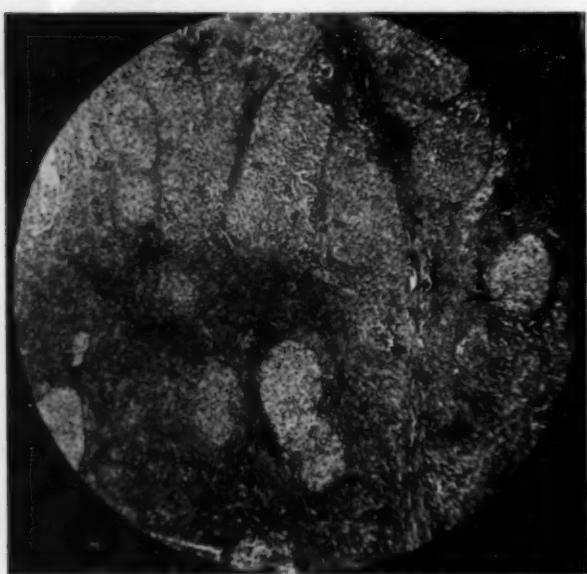


FIG. 1.—Primary endothelioma of cervical lymph-nodes. Low power, showing multiple foci of tumor tissue surrounded by intact lymphoid tissue of the lymph-node.

Acute infectious adenitis of cervical lymph-nodes usually manifests itself in tonsillar infection, abscessed teeth, and ulcer of the scalp, or of the mucous membrane of the mouth or pharynx. The presence of infection in any of these specified areas with reasonable certainty thus explains a glandular enlargement in the cervical region.

Tuberculosis, when manifested in the cervical lymph-nodes, appears first in the sub-maxillary lymph-nodes, and soon afterwards the cervical glands in both sides of the neck become enlarged and continue to grow slowly, and the postcervical, supraclavicular and scapular systems and the bronchial lymph-nodes become affected. Associated rise in temperature and tenderness in the glands, which never characterize primary endothelioma of the cervical lymph-nodes, commonly concur in the presence of tuberculosis. In tuberculosis too, the superficial cervical glands have a tendency to caseation and sinus formation.

## ENDOTHELIOMA OF CERVICAL LYMPH-NODES

For differentiation of this disease and syphilis, a Wassermann usually suffices.

In secondary carcinoma, the primary lesion is usually located in the mouth or pharynx, and where the primary lesion is so located secondary carcinoma can with reasonable safety be diagnosed.

The real test of diagnostic skill lies in differentiating primary endothelioma of cervical lymph-nodes from Hodgkin's disease and lymphosarcoma of the cervical lymph-nodes.

Hodgkin's disease almost invariably manifests itself first in the lymph glands of one or both cervical regions and quickly thereafter a general adenopathy succeeds. The affected glands remain discrete but become enlarged. This disease is thought to be due to infection and for this reason it may become very painful early in the course of the disease. Metastasis to the viscera with resulting pressure symptoms is a common phenomenon in the course

of the disease. Though chronic, this disease is characterized by remissions. Surgery is futile in its treatment and the disease terminates fatally at the end of two and one-half or three years.

Primary endothelioma of cervical lymph-nodes manifests itself first in either the superficial or deep lymph glands of the anterior or posterior cervical regions just as Hodgkin's disease does. Unlike that disease, it invariably manifests itself unilaterally and general adenopathy does not succeed, at least until the late stages. Although the glands remain discrete and become enlarged they do not become painful until the late stages of the disease. Metastasis to the viscera is an extremely rare phenomenon. Remissions do not characterize the disease, but it is consistently progressive. Surgery, while futile and even aggravative of malignancy in the advanced stages of the disease, may in its early stages accomplish a complete cure.

Lymphosarcoma of the cervical lymph-nodes is easily and commonly confused with both Hodgkin's disease and primary endothelioma of cervical lymph-nodes. Between it and the last named disease instant clinical differentiation is simply impossible as the two have almost identical clinical history and physical findings. Fortunately in the early stages of both diseases similar courses are run and to the same treatment both should be subjected. However, lymphosarcoma of the cervical lymph-nodes tends early to involve the

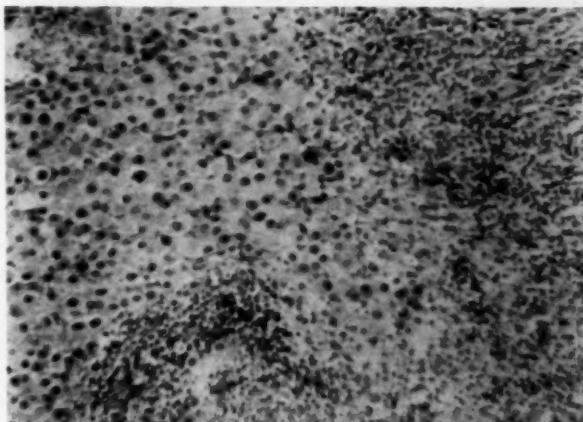


FIG. 2.—High power, showing areas of lymphoid tissue adjoining the endothelioma and giving a comparison in size and staining properties of the tumor cells with the persisting lymphoid cells.

CHARLES W. FLYNN

glands of both sides of the neck and to metastasize first to the supraclavicular regions and then to the mediastinum, and thus, and thus alone, will extended clinical observation admit of differentiation of the two diseases. Such differentiation, while academically interesting, necessarily comes too late to be practically helpful. In consequence, biopsy alone in our present state of knowledge accomplishes any practicable differentiation of these two diseases, and is the only really reliable basis for diagnosis where the presence of either of the three is suspected, and where such presence is suspected, the removal

of a gland or the tumor for microscopic section and diagnosis should be made at the earliest possible moment.

If the microscope reveals endothelioma, the patient should if possible promptly be subjected to a radical block dissection of the cervical glands, and if he is, there is a fair chance of curing him. Of course, in lymphosarcoma,

Hodgkin's disease and

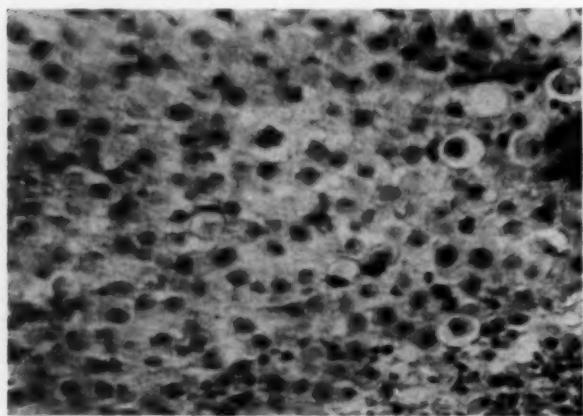
FIG. 3.—High power, showing details of the tumor cells.

secondary carcinoma, surgery avails little, if indeed any. It is highly important to note that even by microscopic examination the differentiation in many cases is extremely difficult.

Among the highly distinguished students in this general field is Dr. Wm. B. Coley of New York, and as an evidence of the difficulties involved in diagnosing this disease I cannot forbear taking the liberty of quoting at length from a purely personal communication recently received from him. In part he says:

In my opinion, based on an observation of a clinically considerable number of cases of tumors of the lymph glands, it is impossible to make a differential diagnosis between endothelioma and lymphosarcoma. Also, I believe in most cases it is extremely difficult to differentiate Hodgkin's disease from lymphosarcoma, not only clinically, but often microscopically as well. I have had cases in which one pathologist has classified the disease as lymphosarcoma, and another pathologist of equal standing has called it Hodgkin's disease. In some of my own cases a microscopical diagnosis of lymphosarcoma has been made at one time, and a little later on, the same pathologist has called it endothelioma. Cases in which it is possible to make a diagnosis of primary endothelioma of the cervical lymph glands, I believe, must be extremely rare.

One of the few cases that I recall in my own experience, in which a definite pathological diagnosis of primary endothelioma of the cervical lymph glands had been made, was seen clinically by one of the leading surgeons of Chicago, who pronounced it definitely inflammatory gland from infected teeth. The patient had a number of teeth extracted, without benefit. The surgeon still believing in the correctness of his diagnosis, sent the patient south for a number of months. When he returned, it was found that the



## ENDOTHELIOMA OF CERVICAL LYMPH-NODES

gland had increased considerably in size; it was then removed, and proved to be a primary endothelioma of the cervical lymph glands. In spite of thorough surgical removal, it recurred promptly. When the patient consulted me, he had a hopelessly inoperable malignant tumor involving the left cervical region as far as the clavicle. In spite of radium and toxin treatment, the disease gradually spread by infiltration, until it involved a large part of the pectoral region as well as the scapular and subscapular region, forming a huge tumor with an area of ulceration in the centre. At the end of a year and one-half, it killed the patient by exhaustion.

The foregoing quotation demonstrates the impossibility of clinical diagnosis and is a caveat of the unreliability of microscopic section as a basis for diagnosis of this disease. Notwithstanding his profound respect for Doctor Coley's matured judgment, the writer believes that microscopic section by a competent pathologist does admit of the definite diagnosis of the disease.

On section the nodes present a moist, firm, friable, grayish-white, smooth surface that changes with variance in the degree of fibrosis or necrosis. The capsule is apparently intact, somewhat thickened, and infiltrated with lymphoid cells. The lymphoid structure of the node is largely lost, although there are areas of fairly dense lymphoid structure, with small blood-vessels, connective tissue cells and large endothelial cells of the same type that make up the main part of the new growth. The general structure is alveolated, the alveolar walls being of various thicknesses of connective tissue cells in all stages and carrying small blood-vessels. The contents of the alveoli are typically large rounded or polyhedral cells with fairly definite cell outlines and nucleus of vesicular type, with prominent basic staining nucleoli, occupying from one-half to three-fourths of the cell. The cytoplasm of the cell is clear. The alveoli are of various sizes and the contained cells appear to spring from the lining. In the centre of the alveoli, particularly the larger, the cells are shrunken, with opaque, deep acid-staining cytoplasm and small dense nuclei (pyknotic). Occasionally there is a central blood-vessel from around which the endothelial cells radiate, giving the appearance of perithelioma, these, however, seem to be simply projections of ruptured alveolar walls as rupture seems to have occurred frequently in the distended alveoli. In some areas the cells are flattened and dense, as from pressure, giving the appearance of carcinoma. The foregoing is the typical and general appearance of primary endothelioma of lymph-nodes as revealed by the microscope.

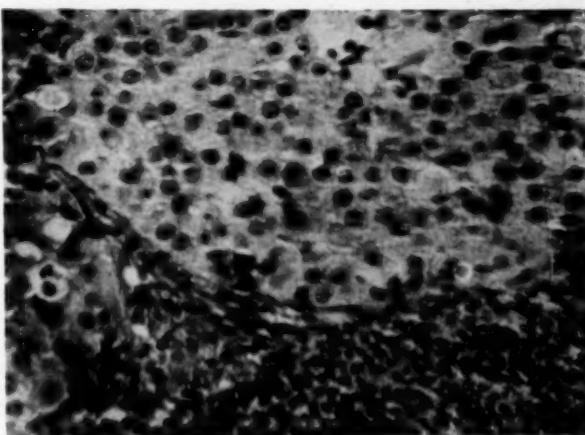


FIG. 4.—High power, showing margin of the tumor mass and the adjoining lymphoid cells.

## CHARLES W. FLYNN

If through biopsic diagnosis the existence of primary endothelioma of cervical lymph-nodes is once established, choice must be made between two courses that alone are available as methods of treatment: palliation by X-ray, radium, and Coley's toxins, or extirpation by surgery. Highly matured judgment should be invoked in making this seemingly simple decision. If the locus of the disease because either of deep seatedness or its generalization does not admit of the complete removal of all diseased tissue, do nothing except palliate. To operate in such a case will surely produce malignant recurrence and hasten the death of the patient. If the locus of the disease does admit of the complete removal of all diseased tissue, an operation should be resorted to immediately, and if properly performed will probably result in a complete cure.

**CASE REPORT.**—In March, 1925, I was consulted by a man twenty-six years old and six feet tall who weighed 210 pounds. He asserted he was in excellent health until two years before when he first noticed a small, hard, painless lump near the angle of the jaw in right side of neck. This mass enlarged slowly without symptoms during the succeeding sixteen months until it attained the size of a bird's egg and he consulted a physician who attributed the enlargement to tonsillar infection or infected teeth. In the month following, August, 1924, seven months previous to the date I was consulted, a tonsillectomy was performed and an impacted tooth and three or four other teeth were removed, all without any apparent beneficial consequences. To me he complained of weakness and loss of appetite and he called to my attention a tumor in the right side of his neck. This tumor, of the size of a walnut, was hard, slightly irregular, rather freely movable, and not adherent to the skin, and gave no evidence of either redness or oedema. A careful search failed to reveal a primary tumor in mouth, pharynx, or elsewhere. I noted the lower cervical chain and posterior cervical glands were enlarged to the size of marbles and that the supraclavicular glands were palpable. An X-ray of the chest disclosed some enlargement of the hilus and bronchial nodes. The Wassermann reaction was negative. The urine was negative. Blood showed moderate anemia; Haemoglobin 80 per cent.; leucocytes 8000; polymorphonuclears 80 per cent.; small lymphocytes, 14 per cent.; large lymphocytes, 4 per cent.; eosinophiles 1 per cent.; and transitory 1 per cent. Temperature 98; pulse 76; respiration 20. March 13, 1925, under gas anaesthesia, a gland was removed for pathological study. A diagnosis of "Primary Endothelioma of Cervical Lymph-nodes" was made.

In the subsequent course of the disease the patient lost weight and strength, suffered from shortness of breath, and an annoying cough that was attended by expectoration of mucopurulent blood-tinged sputum, and ultimately a metastasis to the left breast developed, though no metastasis to the abdominal cavity ever took place. X-ray picture of his chest made several weeks after the diagnosis showed the metastasis more advanced than in the previous X-ray of his chest made previously thereto. The patient received X-ray treatments but the disease progressed steadily without any apparent retardation from this source. He died in September, 1925, two years and six months after the first small, hard, discrete nodule was noted in the right side of his neck. Although an autopsy was urged, the family objected seriously, and it was not performed, which, from the scientific viewpoint is unfortunate.

### CONCLUSIONS

- (1) Primary endothelioma of the cervical lymph-nodes is a more common neoplasm than is generally supposed.
- (2) The disease is limited to one or a small group of glands, more com-

## ENDOTHELIOMA OF CERVICAL LYMPH-NODES

monly the superficial cervical lymph-nodes of the anterior triangle than the more inaccessible cervical glands.

(3) Biopsy is the only reliable method of diagnosis at this time and even that requires the services of a highly competent pathologist.

(4) A suspicious tumor of the neck should always be subjected to biopsic diagnosis early in its development.

(5) Primary endothelioma of the cervical lymph-nodes is now a pathological entity and should become a clinical entity.

(6) If an early diagnosis of primary endothelioma of the cervical lymph-nodes is once definitely made and it is determined same is not the generalized form, an operation should be resorted to immediately, and if properly performed will probably result in a complete cure.

## REFERENCES

- <sup>1</sup> Ewing : Journal Medical Research, vol. xxviii, May, 1913.
- <sup>2</sup> Oliver : Journal Medical Research, vol. xxiv, December, 1913.
- <sup>3</sup> Mitchell : Journal Medical Research, vol. xxiv, November, 1910.
- <sup>4</sup> Kettle and Ross : The Lancet, May, 1921.
- <sup>5</sup> Coley : Transactions of American Surgical Association, 1915.
- <sup>6</sup> Coley : Personal Communication, 1926.

## BENIGN TUMORS OF THE STOMACH\*

BY DONALD C. BALFOUR, M.D.

AND

EARL F. HENDERSON, M.D.

OF ROCHESTER, MINN.

BENIGN tumors of the stomach are of rather unusual interest to the surgeon since they may be the cause of serious complications, may easily be overlooked in the course of a routine examination, and can be dealt with only by surgical means. While they are infrequent, as compared to other tumors of the stomach (Eusterman has shown that less than half of one per cent. of gastric neoplasms are benign), they are encountered sufficiently often to make it imperative to exclude them in every case of unexplained indigestion, and of obscure chronic anaemia particularly. In a recent comprehensive article, Eliason and Wright have reviewed the cases in the literature and discussed fifty of their own, four of which were found at operation. Eusterman and Senty, in 1922, reported a series of twenty-six surgical cases at the Mayo Clinic; the present study is based on fifty-eight cases which have come to operation at the Clinic up to this time.

In this series there were thirty-five cases of benign tumor of the stomach in males and twenty-three in females. The average age of the patients was forty-six years; the youngest was eight years old and the oldest sixty-nine. Sixty-nine per cent. of the tumors were in the pylorus, 26 per cent. in the body of the stomach, and 5 per cent. in the cardia. The cases are grouped according to the type of tumor as follows:

Fibro-adenomatous polyps .....	14
Adenomas .....	4
Fibromas, myomas, fibromyomas, adenomyomas, myxofibromas.....	23
Hæmangiomas .....	4
Polyposis .....	4
Hypertrophied mucosa .....	2
Papillomas .....	1
Dermoid cysts .....	3
Hypertrophied pyloric muscles .....	3
<hr/>	
Total .....	58

The tumors varied in size from 5 mm. to one weighing 1000 gm., a dermoid cyst filling the lesser peritoneal cavity. In forty-five of the fifty-eight cases the tumors were single, and in thirteen they were multiple, including the four cases of polyposis. In twenty-two cases the tumor was associated with other lesions: in five with carcinoma of the stomach, in four with gastric ulcer, in six with duodenal ulcer, in five with cholecystitis, in one with chronic appendicitis, and in one with carcinoma of the cæcum. Malignant degenera-

\* Read before the Southern Surgical Association, December 14, 1926.

## BENIGN TUMORS OF THE STOMACH

tion was found in only two of the tumors, one a polyp and the other a pedunculated adenoma. Ulceration could be demonstrated in 17 per cent. of the tumors.

### SYMPTOMS

Benign tumors per se are symptomless unless complicated by bleeding, ulceration, intermittent obstruction of the pylorus, or interference with gastric motility and secretion due to the size or extent of the tumor. It is exceedingly important to detect those tumors that are responsible for symptoms, and it is fortunate that they can usually be detected by fluoroscopic examination.

The most frequent and the most important sign of benign tumor of the stomach is anæmia. This is usually of the secondary type, but in long-standing cases the anæmia may progress to a point suggestive of the primary type. There are instances in this series in which a diagnosis of pernicious anæmia was made before operation and disproved after the removal of the tumor. Gross hemorrhage has resulted in acute secondary anæmia in a number of cases.

Pyloric obstruction, usually intermittent, occurred in 10 per cent. of the cases. The tumors were usually attached to the posterior wall and, either because of a long pedicle or a redundant mucosa, could be invaginated through the pyloric orifice. From röntgenologic examination one tumor appeared to be entirely within the duodenum and to have its origin there, but exploration showed its pedicle to be on the gastric side of the pylorus.

The symptoms of indigestion of varying degree exhibited in certain cases may simulate those of peptic ulcer, or may be so irregular that no diagnosis can be ventured. Of the cases unassociated with other lesions dyspepsia in some form was noted in 20 per cent. A careful consideration of the type of indigestion found in these cases does not reveal a syndrome on which a diagnosis of benign tumor could be made.

In the series of cases discussed here the only physical findings suggestive of benign tumor occurred in those cases in which the tumor was large enough to be palpated. In only eight was this possible, but in none of these was a clinical diagnosis of benign tumor made independently of the röntgenologic examination. Differential diagnosis is almost entirely dependent on fluoroscopic examination. Seventy-five per cent. of all the patients had been examined by the Röntgen-ray. In 92.6 per cent. of these the röntgenogram revealed the lesion; and in 48 per cent. the lesion was reported to be a benign tumor.

### TYPES OF TUMOR

While the various types of tumor are not distinguished by characteristic differences in symptoms, it is at least of interest to review some of the findings associated with the different type.

*Fibro-adenomatous Polyps.*—Of the fourteen cases of gastric polyp nine were cases of single and five of multiple polyps, there being twelve distinct polyps in one case. In size they varied from 6 mm. in diameter to 8 cm. long by 2.5 cm. wide. One was on the anterior wall, and four on the posterior wall

BALFOUR AND HENDERSON

of the body of the stomach, and nine on the posterior wall in the pyloric region. This type of tumor was more common than any of the other types in patients who had other gastric lesions. Five were associated with carcinoma of the stomach, one with gastric ulcer, one with chronic duodenal ulcer, and one with a hypertrophied pyloric muscle causing obstructive symptoms.

The symptoms in the cases in which there were lesions of the stomach other than the polyps were due to the former rather than to the latter. In the six cases in which there was no associated disease, the chief sign was that of anaemia. In five the anaemia was marked, the haemoglobin in one case being reduced to 32 per cent. and the erythrocyte count to 1,480,000. The blood findings in three of the cases were suggestive of pernicious anaemia. In one the color index was 1+, the hands and feet were numb, and a diagnosis of early combined sclerosis was made. This patient was given two transfusions, and about six weeks later returned to the Clinic much improved. On examination at this time the lesion of the stomach, which had been revealed by fluoroscope at the first examination and thought to be an inoperable carcinoma, was suspected of being a benign tumor. At operation I found multiple polyps on the posterior wall of the stomach, and following their removal the symptoms promptly disappeared and the blood findings improved.

Another patient had tingling in the lower extremities and had received a transfusion a month before coming to the Clinic. Examination here showed that the haemoglobin was 38 per cent., the erythrocyte count was 3,270,000 and the color index 0.5. In all six of the cases of polyps uncomplicated by other disease no free hydrochloric acid was found, which was additional confusing evidence, particularly in differentiating pernicious anaemia, gastric carcinoma, and benign tumor. In five of the six cases the polyps were pedunculated, and one attached near the pylorus had become invaginated 7.5 cm. into the duodenum. Another which arose at the pyloric ring could be moved down into the duodenum or up into the stomach. The pathologic report on one of these polyps, approximately 7 cm. in diameter, situated in the cardiac portion of the stomach, was suggestive of malignant degeneration. Although the tumor was rather inaccessible, I was able to remove it by cautery amputation at the pedicle. The patient also had an enlarged spleen and was advised to undergo splenectomy following removal of the polyp. Four months later the patient returned to the Clinic giving a history of recent loss of weight and continued anaemia. Removal of the spleen was again advised but exploration disclosed a carcinoma extending into the extragastric tissues and apparently originating at the site of excision of the tumor.

In five of the six cases in which anaemia was associated with the polyps a pre-operative diagnosis was made by the röntgenogram. In one case the röntgenogram was negative; when the polyp was excised it measured only 11 by 8 mm. Associated symptoms were rather indefinite. Three patients had experienced gastric distress over periods varying from six months to forty years, but in no case was the distress marked or suggestive of an intragastric lesion.

## BENIGN TUMORS OF THE STOMACH

*Adenomas.*—In the four cases of adenoma three of the tumors were found near the pylorus and the fourth on the anterior wall near the middle of the stomach. These tumors varied from a fraction of a centimetre to 6 cm. in diameter. The history in each case was suggestive of ulcer, although no ulcers were demonstrated. One of the patients showed a severe degree of anaemia and had been treated for pernicious anaemia. A blood examination at the Clinic showed the haemoglobin to be 27 per cent. and the erythrocyte count 3,080,000. After two transfusions the haemoglobin was 50 per cent. This tumor was diagnosed pre-operatively by röntgenograms, and at operation was found to be pedunculated and measured 6 by 4 by 3 cm.

*Fibromas, Myomas, and Similar Tumors.*—Of the group of twenty-three fibromas, myomas, fibromyomas, adenomyomas, and myxofibromas nine were found to be associated with other conditions of sufficient importance to account for the symptoms, the benign tumors being found secondarily. Of the others, the history in seven was suggestive of ulcer, although three patients had no dyspepsia but recurring attacks of haematemesis and melena. In only two cases of the entire group was free hydrochloric acid absent. In twenty of the cases the tumors were single and in three they were multiple. Ten of the tumors were found in close proximity to the pylorus, two in the antrum, two in the midgastric region, and one in the cardiac end of the stomach. Two of the tumors were subserous and varied from 1 to 6 cm. in diameter. Five of the tumors were responsible for varying degrees of obstruction, and one, 5 cm. in diameter, had herniated through into the duodenum for a distance of 12.5 cm., producing an intussusception. One tumor, 3 cm. in diameter, was also pedunculated and had herniated through the pylorus. One, only 1.5 cm. in diameter, produced almost complete obstruction. Six of the twenty-three tumors in this group were ulcerated on the surface but none showed evidence of malignant degeneration.

*Hæmangiomas.*—Three of the four patients with hæmangioma had suffered from slight dyspepsia, and the fourth from recurring attacks of diarrhoea. The outstanding features of this group, however, were the previous occurrence of melena in three cases and of severe haematemesis in one. In only one case was gastric acidity abnormal; there was no free hydrochloric acid. The haemoglobin in two of the cases was 44 and 47 per cent., respectively. The tumors varied from 2.5 to 6 cm. in diameter, and the largest weighed 108 gm. They were all single and pedunculated. Two were ulcerated and none had undergone malignant degeneration.

*Polyposis.*—Three of the four patients with polyposis gave histories of distressing dyspepsia lasting over periods of from four to six years; in one of these cases gastric ulcer was associated and, in the fourth, glossitis. The latter had been diagnosed pernicious anaemia at the Clinic nine months before polyposis was diagnosed. In three of the four cases there was an absence of free hydrochloric acid. The highest estimation of total acidity for the group was 22. In two of these cases nearly the entire area of the stomach was involved. These were both diagnosed by the röntgenogram. A case

which I reported in 1919 was a striking example of the dependability of the röntgenogram in making possible the recognition of such cases. In one case in this group there was a mass of polypoid mucosa, 5 by 8 cm., which could be invaginated into the duodenum.

*Hypertrophied Mucosa.*—There were two cases of hypertrophied mucosa. They did not seem worthy of the name polyposis because of the absence of the characteristic multiple polyps which are the basis for the classification of polyposis. In one of these an area of hypertrophied gastric mucosa in the fundus of the stomach had been associated with symptoms of ulcer for more than three years. Although the patient had a history of melena, there was no evidence of marked anaemia. There was no free hydrochloric acid, and the röntgenologic picture was that of polyposis. This area of hypertrophied mucosa could be easily moved into the pyloric region and was readily excised by clamp and cautery.

*Papilloma.*—There was one case of papilloma in which there was a moderate degree of anaemia and also multiple tumors of the jejunum. These were not removed but in all probability they were papillomas. The patient also had duodenal ulcer.

*Dermoid Cysts.*—There were three patients with dermoid cysts, only one of whom had a history of gastric disturbance. This patient had had repeated hemorrhages (both haematemesis and melena) for about two years. The haemoglobin was 40 per cent. In one case a cyst was situated on the posterior wall of the stomach and was removed by partial gastrectomy. In another case the cyst on the lesser curvature was found secondarily, during an operation for gall-stones. The third case was that of a boy aged eight with a dermoid cyst weighing 1000 gm. on the posterior wall of the stomach. The cyst with a portion of the gastric wall was resected.

#### DISCUSSION

In the fifty-eight cases of benign tumor of the stomach encountered at operation the tumor was removed in fifty-seven, and exploration only was carried out in one case, that of polyposis involving the whole stomach. Patients with marked anaemia were given sufficient transfusions to raise the percentage of haemoglobin to a satisfactory level and, when necessary, the operation was performed under local anaesthesia. Of the thirty-six cases in which the tumor was the only lesion, the tumor was removed by excision alone in seventeen, and in the remainder (except in the case of exploration) the segment of the stomach containing the tumor was resected. The situation of the tumor determined the best method of approach. The procedure used most frequently was transgastric excision through an incision in the anterior wall, and division of the pedicle by the cautery. In the larger tumors the possibility of malignant degeneration makes partial gastrectomy advisable; I have had at least one case in which carcinoma developed at the site of the attachment of the pedicle.

#### BENIGN TUMORS OF THE STOMACH

In the uncomplicated benign tumors there was no operative mortality. In a case in which the primary condition was carcinoma of the stomach, death from bronchopneumonia occurred six days after operation.

#### BIBLIOGRAPHY

- <sup>1</sup>Balfour, Donald C.: Polyposis of the Stomach. *Surg., Gynec. and Obst.*, 1919, vol. xxviii, pp. 465-467.
- <sup>2</sup>Eliason, E. L., and Wright, V. W.: Benign Tumors of the Stomach. *Surg., Gynec. and Obst.*, 1925, vol. xli, pp. 461-472.
- <sup>3</sup>Eusterman, G. B., and Senty, E. G.: Benign Tumors of the Stomach. *Surg., Gynec. and Obst.*, 1922, vol. xxxiv, pp. 5-15.

## UNILOCULAR CYST OF THE SPLEEN\*

BY L. WALLACE FRANK, M.D.

OF LOUISVILLE, KY.

ALTHOUGH reports of non-parasitic cysts of the spleen had appeared in the literature at various times, it was not until 1904 that any great interest was taken in the subject. At that time articles by Heinricius, Monier, and Lasperes appeared in Germany and in the following year Bryan made his contribution. In 1906, Powers collected thirty-two cases and in 1913, Fowler enumerated eighty-five cases of non-parasitic cysts of the spleen and added one of his own. By 1921, five additional cases had appeared in the literature and were again compiled by Fowler. In the past five years reports and studies by Pribram, Gosselin, Moynihan and others have added to our knowledge of the subject.

Non-parasitic cysts of the spleen have been grouped by Fowler in the following manner:

1. True cysts.
  - a. Infestation cysts (inclusions of the peritoneum, inflammatory or traumatic), small and multiple, may be superficial or deep.
  - b. Dilatation cysts—polycystic disease of the spleen resulting from dilatation of the splenic sinuses. Multiple.
  - c. Neoplastic cysts as lymphangioma or haemangioma. Often it is impossible to differentiate these from the previous type.
2. Pseudocysts.
  - a. Traumatic. These may arise from a haematoma and are usually large and unilocular.
  - b. Degeneration cysts. These arise from secondary changes in infarcted area. They are usually large and solitary.

Howald, of the Pathological Institute of the University of Geneva, follows this classification as do also most of the recent writers.

It is not our purpose to discuss the minute serous cysts. They are usually discovered at autopsy or accidentally in the course of operations and are not as much of surgical interest as of pathological. It is toward the large solitary cysts of the spleen that we would direct your attention. Of the ninety-one instances of non-parasitic cysts of the spleen which were collected by Fowler in 1921, sixty-five belonged to this group. In a search of the literature we have been able to collect six more such cases and are adding two, one of our own and one of Abell's. We have seen another case in which we made a diagnosis of a splenic cyst, but we have not included it in this report as the diagnosis has not been confirmed by operation.

Pool, in his monograph "Surgery of the Spleen," states that it is the general opinion of surgeons and pathologists that most of the cysts of the

\* Read before the Southern Surgical Association, December 16, 1926.

### UNILOCULAR CYST OF THE SPLEEN

spleen demanding surgical intervention are hemorrhagic in origin. Our analysis of seventy-three cases of large cysts of the spleen would substantiate his statement in that we found forty-eight, or almost seventy per cent., were blood cysts. Howald states that small cysts are frequently associated with the large solitary cysts and that the small ones may even be microscopic. It is his belief that the blood cysts, so called, are usually due to secondary hemorrhage into a serous cyst, as the study of his two cases revealed that the fluid of the



FIG. 1.—Anterior surface of spleen containing cyst in the lower portion. No break in splenic capsule could be noted.

small cysts was serous in character while that in the large ones was bloody in each case.

All authorities are agreed that trauma plays an important factor in the etiology of splenic cysts. In the seventy-three cases studied by us there was a history of trauma in eighteen. Of these eighteen, only ten were blood cysts so we cannot infer that trauma is the only cause of the hemorrhagic cysts.

Sex, or rather menstruation and pregnancy, may play important etiological rôles. Of the seventy-three reviewed cases forty-seven, or sixty-four per cent., occurred in women. This is in accord with the figures of Hamilton and Boyer, who found sixty-five per cent. in females. Of the forty-seven cases occurring in females, twenty-five were between the ages of twenty and forty, and ten occurred in association with pregnancy. Monnier explains the

L. WALLACE FRANK

incidence of occurrence during the reproductive period by the fact that the spleen becomes congested in pregnancy, during menstruation and at the menopause and subsequently relaxes. The content of the cysts which are related to pregnancy is stated in nine cases, only five were blood cysts. This apparently refutes Bircher's explanation for the development of the cyst at this period, as he attributes it to embolism, infarction and hemorrhage following pregnancy. Powers states that aside from the information furnished by



FIG. 2.—Inferior surface of spleen containing cyst in the lower portion. The tie is small excrescence punctured during removal.

sex and age, the meagreness of the reports makes accuracy impossible. Trauma and antecedent disease of the spleen such as malaria may act as contributory causes in not a few cases. "Regardless of the original cause," says Powers, "we often find recorded an acute exacerbation in the symptoms and aside from childbirth we know nothing of the cause for such exacerbations."

As stated above, previous disease of the spleen may be a predisposing factor in the formation of cysts. In the seventy-three cases which we reviewed, there was a definite history of malaria in twelve, and one occurred during an attack of mumps.

As to the underlying cause of the large cysts of the spleen we are inclined to believe with Howald that all primarily are serous in character. Furthermore, we think that in the beginning they are all small and result from a dilatation of the normal lymph spaces in the organ. In many specimens there is no definite lining wall but a thin smooth membrane, in others there is a definite endothelial lining which is also found even in some of the blood cysts.

## UNILOCULAR CYST OF THE SPLEEN

As to the symptoms, these vary with the size of the tumor, and the presence or absence of adhesions. Practically all patients complain of discomfort in the left hypochondrium.

The ideal treatment is splenectomy. In the sixty-five cases which Fowler collected splenectomy was done thirty-three times, and of this number one died and the result in two cases is not stated. Of the eight cases which we have compiled, splenectomy was done in each instance, five recovered and the result is not stated in three. In those cases where adhesions are very dense marsupialization of the sac may be necessary.

As we have stated, Fowler had collected up to 1921, ninety-one cases of non-parasitic cysts of the spleen of which sixty-five may be grouped in the class of large cysts. Since 1921, six additional reports have appeared.

I. PRIBRAM, E. E. (*Monatschr. f. Geburtsh. u. Gynak.*, vol. lvii, p. 164) reports two cases.

1. Female, forty, para iv. Pain three months and enlarging abdomen. Tumor in the left side of the abdomen the size of a child's head. Operation disclosed a cyst of the spleen arising in the lower pole and involving the entire organ and could not be separated from it. Splenectomy. Cyst contained serous fluid and the wall was very thin, diagnosis of lymph cyst was made. There was nothing in the history to suggest the etiology and the wall was not studied. The outcome of the operation was not stated.

2. Female, forty-six, para iv. Doctor said spleen was enlarged during the first pregnancy. Swelling in the abdomen for the past year. On the left side was a tumor the size of a child's head below which was a distinctly fluctuating mass. Blood count was normal. Laparotomy revealed an enlarged cystic spleen covered by omentum but freely detached from it. The spleen hung down by the phrenico-lineale and gastro-lineale ligaments and was rotated about these ligaments through an angle of 180 degrees.

The day after operation the white blood count was 30,000 with sixty-seven per cent. polymorphonuclears, six per cent. lymphocytes, ten per cent. mononuclears, five per cent. transitionals, and twelve per cent. eosinophiles. Fourteen days later the red count was 5,400,000 and the haemoglobin sixty-three per cent., the white blood count was 5200 with seventy-two per cent. polymorphonuclears, nine per cent. lymphocytes, five per cent. mononuclears, three per cent. transitionals and eleven per cent. eosinophiles.

The spleen weighed 1050 grams, 18 x 12 cm. and there was a large solitary cyst containing 575 grams of yellowish-gray thick fluid. Microscopically this showed mostly broken down red cells and cholesterol crystals. The wall was smooth and had attached a few small pieces of calcified material. There was no definite lining to the cyst and the wall was composed of connective tissue. The author states that this may have been a blood cyst.

II. GAMBILL, W. L. (*Ky. Med. J.*, vol. xxi, p. 247) reported a case of a serous cyst of the spleen in an Italian woman aged forty-one, para iv. The oldest child was fourteen years and the youngest eight months. Complaint was of pain in the left hypochondrium for four years. Had lost twenty pounds in weight. Operation revealed a cyst at the hilus of the spleen between the layers of the gastro-splenic omentum. Pancreas and omentum were adherent to the growth. The cyst contained one-half gallon of serous fluid which when examined revealed no hooklets nor solices. Splenectomy was done, patient recovered. (Apparently no study of the cyst wall was made.)

III. GOSSELIN, R. I. (*Journ. A. M. A.*, vol. lxxxii, p. 849) reported a case of unilocular cyst of the spleen in a woman who had had malaria at the age of seven. The patient was forty-five years of age when seen and the tumor had existed for ten years

L. WALLACE FRANK

and had gradually increased in size. For seven years previously the patient had been subject to high blood-pressure. Laparotomy revealed no twist of the pedicle but many adhesions to the diaphragm. Successful splenectomy was done. The cyst contained 2000 c.c. of thin dark brown fluid in which was a large amount of cholesterin and blood pigment. The lining wall had a rough and irregular appearance caused by the adherence of some soft friable material which when scraped off left a smooth surface. The cyst wall consisted of a thin layer of splenic tissue between the splenic capsule on the outside

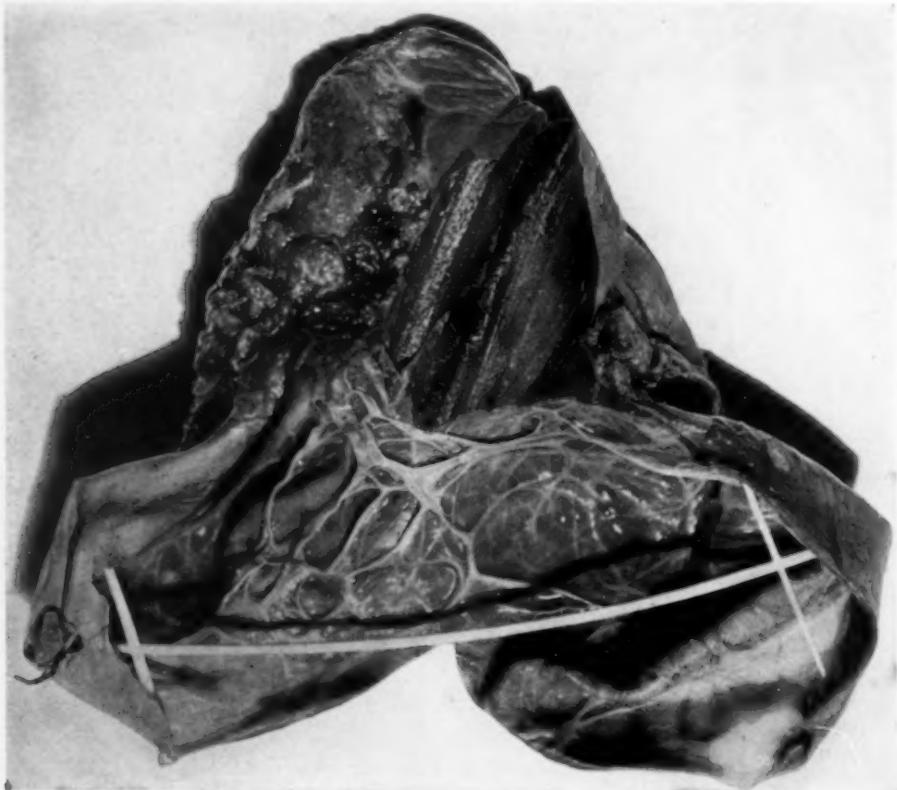


FIG. 3.—Cyst opened, showing smooth lining membrane and trabeculation.

and an inner layer of amorphous pink-staining material. The main division of the splenic artery was thrombosed though apparently not of recent origin.

IV. HOWALD, R. (Frankfurt. Ztschr. f. Path., vol. xxxiii, p. 349) reported two cases.

1. Hemorrhagic cyst of the spleen removed by Doctor Kummer in 1909, from a patient thirty-eight years old. No other details are stated.

2. Female, aged twenty-eight, was operated three times in the course of five years for a tumor in the abdomen, and at the third operation a cyst of the spleen, weighing 3500 grams was removed. The capacity of the cyst was 2900 c.c. and the content was hemorrhagic. The cyst involved the entire spleen and the wall was composed of splenic tissue. In this wall were many small cysts the contents of which were for the most part hemorrhagic. The splenic tissue was markedly altered, the follicles being very few and small. The inner wall of the cyst had in many places an endothelial lining and beneath these cells was connective tissue poor in nuclei. Elastic fibres were only rarely seen. Some sections did not show an endothelial lining but a smooth wall. Most

## UNILOCULAR CYST OF THE SPLEEN

of the small cysts had an endothelial lining beneath which was the connective tissue poor in nuclei.

V. ABELL, I. (Personal communication) operated a woman, aged twenty, para 1, whose complaint was a tumor in the abdomen, discomfort in the left hypochondrium and a smothering sensation on reclining. Patient had malaria at twelve, following which a mass the size of an orange appeared in the left upper abdomen. This mass gradually enlarged but caused no decided discomfort until a year ago. Wassermann was strongly positive. Tumor was not tender and extended from the left costal margin to below the umbilicus and moved with respiration. The blood count was normal except for a slight leucocytosis. Laparotomy revealed a cystic tumor of the spleen which filled the entire left abdomen. The omentum was adherent to the tumor and these adhesions were separated and splenectomy was performed, the patient making a good recovery, although the convalescence was complicated by a purulent pleurisy.

The specimen consisted of a spleen, ovoid in form,  $26 \times 19 \times 17$  cm. with attached fibrous tags and large tortuous vessels on the surface. At one end there was apparently normal splenic tissue measuring  $7 \times 8 \times 2$  cm. When sectioned the mass is found to consist of a single cavity 22

cm. in its greatest diameter. The content was pale greenish, grayish-white, thick fluid in which was floating dull grayish-white, soft, flakey masses. The splenic artery and vein were apparently normal. Examination of the fluid showed a large number of pus cells of which about forty per cent. were eosinophiles. The fluid contained albumin and cholesterin and was sterile on culture.

VI. The case which we wish to add to those previously mentioned was a negress, aged twenty, who was referred to us on February 24, 1926, by Dr. E. C. Wood, of Bloomfield, Ky. She has been married for two years and has had one child and no miscarriages. The family history was entirely negative as was also her past history. She had never had malaria and there was no history of trauma. For about a year she had suffered with a dull ache in the upper left abdomen. Following the birth of her child five months ago she noticed a tumor in the abdomen beginning under the left rib margin and gradually enlarging downward. It was freely movable with change of posture. No gastro-intestinal, cardiac or pulmonary symptoms were present. There were no urinary symptoms and no loss of weight. During the past few weeks she has had pain in the region of the tumor. Menses normal.

Examination revealed a healthy looking, young, colored girl. There was no enlargement of the superficial lymphatic nodes. No enlargement of the thyroid gland was present and the heart and lungs were normal to physical examination. Blood-pressure 120-78.

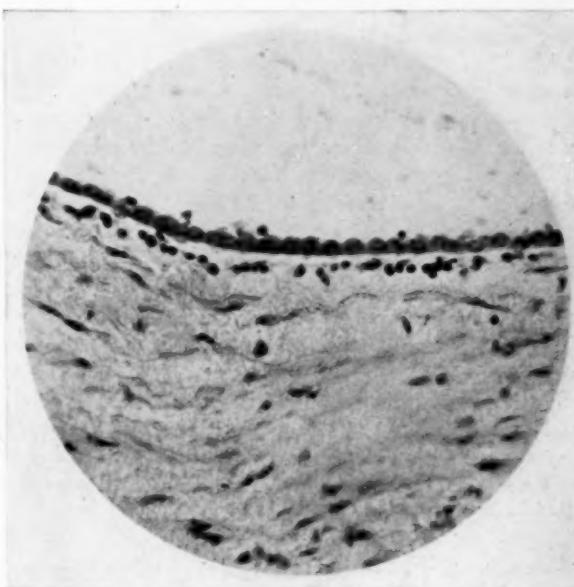


FIG. 4.—Note the dense fibrous tissue wall lined with its single layer of cells, resembling mesothelium or endothelium. (Magnification 335 diameters.)

## L. WALLACE FRANK

In the upper left abdomen was a rounded, smooth tumor about eight inches long and six inches wide. Fluctuation was present. No notches could be felt. The tumor was freely movable but could not be pushed into the pelvis. When the patient lies on her right side most of the tumor was to the right of the midline and at about the level of the umbilicus. In this posture percussion over the splenic area revealed the absence of normal splenic dulness. The left kidney could not be palpated.

Except for tenderness in the vaginal vault and a slight cervical laceration, the vaginal examination was negative.

Urinalysis revealed a faint trace of albumin and a large number of pus cells.

The blood count showed eighty per cent. haemoglobin; red blood-cells 4,480,000; white blood-cells 6000, of which forty per cent. were polymorphonuclears, fifty-nine per cent. lymphocytes and one per cent. mononuclears. The Wassermann was negative.

A cystoscopy was done and except for some pus floating in the bladder that organ was normal. A catheter was passed to the left kidney and ten c.c. of fifteen per cent. sodium iodide solution was injected. A röntgenogram was then made with the tumor lying in its usual position in the upper abdomen. The tumor was then pushed down toward the pelvis and another plate taken. This revealed a normal renal pelvis in the usual position and that the kidney had not been moved.

Having such data we made a diagnosis of cystic tumor of the spleen. Operation through a left rectus incision revealed a cystic tumor involving the lower half of the spleen. The tumor measured 20 x 15 x 12 cm. Over its lower part were some omental adhesions which were easily separated. The tail of the pancreas was closely associated with the spleen at its hilus. There was no twist of the pedicle. The pedicle was clamped and doubly ligated and the spleen with tumor removed. While manipulating the tumor in its removal one of two small excrescences on the cyst was ruptured and about a pint of greenish fluid escaped. Examination of the abdomen revealed no other pathology and the wound was closed en tier.

The patient made a very uneventful convalescence and the wound was dressed on the fourteenth day, when she left the hospital. Since operation she has apparently had perfect health.

The specimen of splenic cyst was studied by Dr. Stuart Graves of the University of Louisville, who submits the following report. The specimen consists of a large spleen with a cyst measuring approximately 45 x 130 x 160 mm. in its greatest diameter. The cyst has evidently been tapped with a trocar and a good deal of the fluid removed. Capacity of the cyst was 900 c.c. Weight with the cyst content largely removed 353 grams. The cyst occupies a little more than half of the mass. The outer wall is thin and translucent, color varying from pale gray to dark bluish red. Otherwise the surface is smooth and normal. After fixation in Kaiserling fluid the cyst is opened and found to be unilocular, the inner surface being smooth and glistening and marked with interlacing trabeculae. From the solid splenic tissue the cyst is separated by a fibrous wall about 1 mm. in thickness. As elsewhere, this wall is thin and translucent, smooth and glistening on the inside and intimately connected with splenic tissue on the outside. The cut surface of the splenic tissue itself shows cross-sections of trabeculae relatively numerous, otherwise the cross-section is not abnormal.

The microscopic examination of sections of the solid portion of the spleen and of the wall of the cyst show the latter to consist of dense fibrous tissue, lined with a single thin layer of cells. These cells have ovoid nuclei, are rather pale, and are fairly close together. In the solid portion of the spleen the trabeculae are relatively numerous and close together. The lymph follicles are small and relatively more numerous and closer together than normal, indicating compressed splenic tissue.

Bacteriological examination of the fluid removed from the cyst show all smears and cultures, both aërobic and anaërobic, negative for growth after five days.

### UNILOCULAR CYST OF THE SPLEEN

Physical and chemical examination of the fluid shows it to be slightly turbid, pale greenish in color, and about the consistency of ascitic fluid. The specific gravity is 1.016. Microscopic examination of the centrifuged sediment shows some flat crystals, evidently cholesterol, and moderately numerous endothelial leucocytes filled with vacuoles which stain red with Scharlach R. The chemical examination shows no chlorides, sulphates, phosphates or bile. Traces of blood and cholesterol are present. The albuminous material is approximately seven per cent. The reaction is alkaline.

Reference to the gross and microscopic description in this case shows conclusively that this cyst is non-parasitic. Its size, its single chamber, its lining and the physical and chemical examination of its fluid would indicate that it may have begun either as an infoliation or a dilatation cyst and then gradually enlarged to the size recorded. This size must have been gradually attained over a considerable period of time because the wall was strong and well formed and the contents were practically negative for any blood constituents. The lining cells appear more like mesothelial and endothelial cells, which also adds evidence in favor of an infoliation or dilatation cyst.

## TRAUMATIC ABSCESS OF THE SPLEEN\*

BY WILLIAM DE P. INLOW, M.D.

OF SHELBYVILLE, IND.

UNDER traumatic abscess of the spleen I shall consider those collections of pus, splenic and perisplenic, in the left subdiaphragmatic region, resulting from secondary infection and suppuration of a contused spleen or of a haematoma arising from injury to splenic tissue. Such traumatic abscesses of the spleen are rare. In a search of the available literature I have been able to collect only twenty-three cases exclusive of one of my own herewith reported. The first of these was described by Henning in 1757. Doubtless, however, the condition is more common than this small number would indicate. These abscesses constitute about 15 per cent. of the total number of abscesses of the spleen (Küttner, Scheyer). They are much less common than those having as a basis either metastatic inflammation or infarcts occurring in the course of septic diseases, typhoid fever, recurrent fever, malaria, dysentery, and influenza, which together constitute about 75 per cent. of the cases. The third group of splenic abscesses, that of suppurations caused by extension from neighboring organs, chiefly from carcinoma and ulcer of the stomach, is still more rare than the traumatic. The group here under consideration differs sufficiently from the ordinary splenic abscess, not only in its etiology, but also in its clinical picture and prognosis, to justify its separate presentation.

*Pathogenesis.*—The spleen, soft and vascular, offers but little resistance to injury; yet, due to its small size and protected situation under the ribs, damage to it is infrequent. Even more easily traumatized is the diseased spleen, since the hypertrophied organ not only offers a less resistant tissue, but also a greater surface to be injured, coming partially out from protection under the rib margin.

Any injury to the left side of the body may be associated with damage to the spleen. When the left lower part of the chest is forcibly struck and ribs are fractured, or when the enlarged organ is struck in the left hypochondrium, damage to the spleen is especially probable. The methods of injury are varied: falls, direct blows with fist or cane, being run over by vehicles, gunshot wounds, horse kicks, anything whereby direct violence is applied to the splenic region. Further, such apparently trivial acts as sneezing or heavy lifting may tear the diseased spleen. When the spleen is injured it either ruptures or is contused. When it ruptures and the larger blood-vessels are torn, death may occur from profuse hemorrhage or be averted only by the timely removal of the spleen. Rupture of the spleen, however, may be minor, and the symptoms not those of a major abdominal catastrophe;

\* Read before the Association of Resident and Ex-resident Physicians of the Mayo Clinic at Rochester, Minnesota, October 7, 1926.

### TRAUMATIC ABSCESS OF THE SPLEEN

indeed symptoms pointing to the spleen may be completely masked by the associated injuries which are more patent, such as fracture of the ribs or limbs, and injuries to the head with coma. In such instances the bleeding may not be great, the hemorrhage is spontaneously arrested and a perisplenic haematoma forms. Portions of the splenic tissue itself may be so contused that they are no longer viable and may come to form part of the subdiaphragmatic collection. When the injury sustained is less severe contusion alone occurs. In this event the tissue is injured without solution of continuity, small extravasations of blood and subcapsular haematomas may occur, but the capsule itself is intact. After a slight injury the tissue recovers if the extravasated blood is gradually absorbed; there then remains only a scar in the splenic tissue as a sign of the injury. However, the extravasated blood is not always absorbed. Frequently it becomes encapsulated and forms a cyst. Such a cyst may remain dormant for years only later, frequently after a fresh trauma, to grow and become of clinical significance.

More rarely and instead of the formation of a cyst, infection of the collection of extravasated blood may occur. It is this contingency that demands that contusions of the spleen be taken seriously because of the conditions which can follow such an injury rather than because of the immediate surgical indications. Although there exists in the spleen less opportunity for infection than, for instance, in the liver with the presence of bile and the bacterial content of the portal blood, or in the kidney with its connection with the bladder, yet such infection occurs. The pyogenic organisms can come only through the arterial blood stream or by extension from a neighboring focus. When such infection occurs, the haematoma, splenic or perisplenic, suppurates and there develops a traumatic abscess of the spleen in the sense defined in this paper.

Such a splenic abscess may not contain pus alone; often it contains also free pieces of necrotic splenic tissue of varying size. Indeed, the entire spleen may be composed of a sequestrum. It is to such abscesses that Küttner has given the name "sequestrating abscess of the spleen." Such sequestra are not limited to the cases of traumatic abscess, but also occur as a result of infarction in the other groups of splenic abscess. About 37 per cent. of all splenic abscesses are of this type. If the contusion to splenic tissue is great, the contused area goes on to necrosis. The secondary suppuration separates the necrotic portion and leaves it as a sequestrum. It is possible also that several areas of contusion may suppurate and the intervening tissue necrose from interference with its nutrition. In the few instances where the entire splenic parenchyma has been loosened from its capsule, there was formed probably a subcapsular haematoma which spread out under the whole capsule. Generally, however, the splenic capsule does not hold and rupture occurs. Küttner was able to produce experimentally in rabbits the sequestrating type of abscess by first contusing the spleen and then injecting staphylococci into the blood stream. In two only of the cases of traumatic abscess collected here were any bacteriologic studies of the pus made. In the

WILLIAM DEP. INLOW

case of Weichert streptococcus pyogenes was found; in that of Omi the pus was sterile. It is probable that the ordinary pyogenic organisms are responsible, and that the pus is sometimes sterile in latent cases of long duration. The source of the infecting organisms is not always evident. In the case of Lampe it was a felon; in that of Trapp furunculosis; in that of Weichert an infected compound fracture-dislocation at the wrist. It seems reasonable that the splenic flexure of the colon, as the result of slight associated trauma, might permit the passage of organisms to the splenic area. The pus obtained has been described frequently as foul-smelling such as occurs in infections due to the colon bacillus.

*Symptoms and Course.*—Traumatic abscesses of the spleen run a fairly typical course which differs only in certain respects from that of abscesses of the spleen of different etiology. For purposes of ease of clinical description, I have divided this course into three stages: (a) stage of initial injury; (b) intermediate or cryptic stage; (c) terminal stage, or stage of extension or rupture. Similarly I have divided the cases into four groups which differ somewhat not only in the picture presented, but also in the ease of recognition and in prognosis: Group 1, in which the injury was more or less limited to the splenic area; Group 2, in which the injury to the splenic area was associated with other injuries; Group 3, in which the injury caused symptoms indicating early operation, and Group 4, in which the cases were all latent.

*Group 1.*—The cases in this group are the most typical and occur the most frequently. In the initial stage the patient receives an injury from blunt force, either to the left hypochondrium or to the left lower part of the chest wall. There is immediate pain and tenderness in the contused area which may be transient or persistent. The pain may be increased by deep breathing. Within a few hours slight enlargement of the spleen may be noted on palpation and percussion; if the injury is limited to the upper pole little change may be demonstrable. Shock and signs of marked hemorrhage are absent, yet there may be symptoms of peritoneal irritation with initial vomiting. The symptoms soon tend to subside and it is believed that the patient will rapidly recover. This marks the beginning of the intermediate stage. There may be a period of almost complete freedom from symptoms, or the patient may complain of only slight persistent pain or heaviness in the splenic region; in intrasplenic collections of pus pain may not be felt for a long time. Soon, however, there develops a cryptic fever which may gradually increase in the height of its afternoon rise. There may be chills. Often there are night-sweats. The patient is weak and has anorexia. Splenic enlargement may increase, or may appear for the first time, taking the form of a mass in the left hypochondrium or of a bulging of the left lower thorax with edema in the overlying skin. Fluctuation will occur only when as the result of adhesion to the abdominal wall the abscess comes close under the abdominal parieties. In the terminal stage the abscess develops complications if it is not evacuated operatively. The pleura is most frequently involved. This occurs chiefly in abscess of the upper pole. Pleural effusion occurs which

## TRAUMATIC ABSCESS OF THE SPLEEN

may be repeatedly aspirated, or it becomes purulent and forms empyema. If the abscess is not evacuated by operation it ruptures. This occurs, in order of frequency, into the stomach with vomiting of pus, into the peritoneum with peritonitis and death, into the colon with passage of pus in the stool, through the chest wall with fluctuant elevation of the skin, into the renal pelvis with pyuria, or into the pleural cavity. The direction of rupture depends largely on the location of the abscess, chiefly toward the stomach if it is in the upper pole, or toward the peritoneum if it is in the lower pole. Even if the abscess has been incised and drained perforation may occur. Cases in this group run their course in from two weeks to four months, in an average of two to three months.

*Group 2.*—In this group the traumatic force is greater and more widely distributed, and there are also other injuries. The initial stage is much more severe. The patient may be unconscious. Shock and profuse hemorrhage are frequent. The more patent, and for the time being more important, injuries, such as compound fracture of the extremities, and trauma of the chest with haemoptysis, distract attention from the splenic area so that damage there is easily overlooked. Not until the intermediate stage when the patient is recovering from the injuries for which he is being treated may it dawn upon the surgical attendant that all is not well. The patient still remains ill, the hectic fever seems inexplicable, and it is only at the terminal stage when complications occur that the true nature of the events, as determined by operation or necropsy, is realized. My own case belongs in this group.

*Group 3.*—In this group the initial symptoms are those of rupture of the spleen. The patient suffers a major abdominal catastrophe as the result of the injury. Signs of hemorrhage and shock are present, and the abdomen is tender and rigid. Operation is performed, blood evacuated from the abdomen, and tamponade or removal of the ruptured spleen performed. Following this the patient who is apparently recovering develops symptoms of infection in the left subdiaphragmatic space. These progress until death or a subsequent operation for evacuation of an abscess which has formed in an unremoved blood clot or in the remaining contused splenic parenchyma.

*Group 4.*—This group differs from Group 1 only in the time interval and in the latency of the symptoms in the intermediate stage. The patient recovers from the injury and is apparently symptomless, or at most suffers from a vague indisposition, for from one to several years. Cachexia is frequent. Distress may occur in the left hypochondrium. A mass, often fluctuant and reaching large proportions, is usual at the left costal margin. In the terminal stage either a large amount of pus is evacuated at operation, or the abscess empties itself by perforation with the patient experiencing the sensation of something rupturing or tearing inside him.

*Diagnosis.*—Diagnosis may or may not be difficult. In Group 1 attention is at once centred on the spleen as the seat of possible injury, and when persistent fever develops an abscess is at once thought of. In Group 3 the state of affairs is largely self-evident. However, in Group 2 the condition is

WILLIAM DEP. INLOW

obscured and may be entirely overlooked. In Group 4 the long time intervening between the initial stage and the stage of marked clinical symptoms may cause both patient and examiner to suspect no connection between the large splenic tumor and the injury sustained. Bogdanik elicited a history of injury in his case only after operation.

Exploratory puncture through the chest wall with aspiration is a procedure that cannot often be dispensed with in establishing a diagnosis, especially of abscess of the upper pole. It is not without danger. In case of positive findings operation should follow immediately in order to avoid spreading the infection along the tract explored by the needle into an uninvolved pleural cavity. Examination by means of the Röntgen-ray has seldom been employed since many of the cases occurred before the advent of röntgenology. Such examination may be negative, or at most may show a high-lying, fixed diaphragm on the left. In Scheyer's patient an air bubble was seen beneath the diaphragm. The finding at operation of necrotic masses in chocolate-colored pus points to the spleen as the seat of origin in all subphrenic abscesses on the left side. Remains of the trabecular system seen on microscopic examination of the necrotic tissue identify it as splenic.

*Treatment.*—The treatment is surgical. The abscess must be adequately incised and free drainage established. Two chief routes of approach are available. In abscess of the upper pole the perpleural transdiaphragmatic route with rib resection is indicated. In abscess of the lower pole with encroachment on the peritoneal cavity, laparotomy, either at the rib margin or through a left rectus incision, may be preferable. Lumbar incision is seldom indicated. The operation of choice is splenotomy with tamponade. When the whole spleen exists as a sequestrum it should be removed. In cases in Group 3 splenectomy is indicated at the primary operation; if the splenic region cannot be freed completely of blood and damaged tissue, or if subsequent oozing of blood is probable, drainage should be provided. Circumstances will determine whether operation should be performed in one or in two stages. With care infection of the pleural or of the peritoneal cavity may be avoided in most instances; if so, the entire procedure is carried out in one stage. In the cases reported in this paper approach has been chiefly through the chest wall with resection of the tenth rib. Bogdanik sewed the spleen to the abdominal wall.

*Prognosis.*—The prognosis is grave. In this series of twenty-four cases there were fourteen deaths, a mortality of 58 per cent. The prognosis is worst in Groups 1 and 2, and best in the latent cases of Group 4. Thirteen patients were operated on with five deaths, a mortality of 38 per cent. Among the eleven others there were nine deaths, or a mortality of 82 per cent. Recovery occurred in two latent cases, following rupture into the stomach and renal pelvis in one instance and into the stomach and colon in the other. Thus death occurred in all the medical cases in this series except the latent ones. With more frequent correct early diagnosis and timely surgical intervention doubtless these results will be improved.

## TRAUMATIC ABSCESS OF THE SPLEEN

### REPORT OF A CASE

A man, aged nineteen, was admitted to the W. S. Major Hospital, July 13, 1924, at 10.00 P.M., with a diagnosis of compound fracture of the humerus. At 3.00 P.M., while riding a bicycle he had been struck by an automobile. He was knocked high into the air and alighted on his left side, with his left arm twisted beneath him. He was unconscious for a short time and lost about a pint of blood. On being taken to the office of a country physician for first aid he fainted, and again on admission to the hospital. He complained chiefly of the injury to his left arm, but stated also that he was extremely sore throughout his left side, especially in the left abdominal, lumbar, and anterior-chest regions.

Examination revealed that the patient was badly injured, pale, and faint. There was a compound fracture of the left humerus in the middle third with marked laceration of the skin. He was unable to extend the fingers of the left hand or the hand itself. The left radial pulse was not palpable. Nothing abnormal could be detected in the heart or lungs. He was tender to pressure throughout the left anterior part of the chest and the whole left side of the abdomen. The abdominal wall was not rigid, and no free fluid could be demonstrated in the abdominal cavity. A catheterized specimen of urine showed no blood, but contained albumin and also many casts. The haemoglobin was 75 per cent; the temperature 98°; the pulse rate 78; and the respiratory rate, 30.

An hour later the lacerated tissues of the arm were excised under anaesthesia and a large haematoma was evacuated. There was much venous bleeding which was controlled by packing with iodoform gauze. The arm was put up temporarily with a triangular axillary pad and external splint and strapped to the body.

The next morning the patient complained of pain inside the left side of the chest, coughed up a little blood-streaked sputum, suddenly became dyspnoëc with a respiratory rate of 40, and pulse rate of 140, sweat profusely and appeared in shock. The blood pressure, however, was 110 systolic and 60 diastolic. It was difficult to examine the chest posteriorly, but partial examination disclosed nothing save tenderness to pressure. Voiding was impossible until the following day, when he was much improved; the pulse rate had dropped to 110. Two days later the arm was put up in suspension from a Balkan frame and traction applied to the elbow. The wound was at first irrigated with Dakin's and later with physiologic sodium chloride solution. The temperature was 100°, the pulse rate 100, and the respiration rate 30. Albumin and casts had disappeared from the urine.

Following this, save for an occasional involuntary stool, the patient seemed to be in good condition and had little complaint. However, he began to run a persistent septic

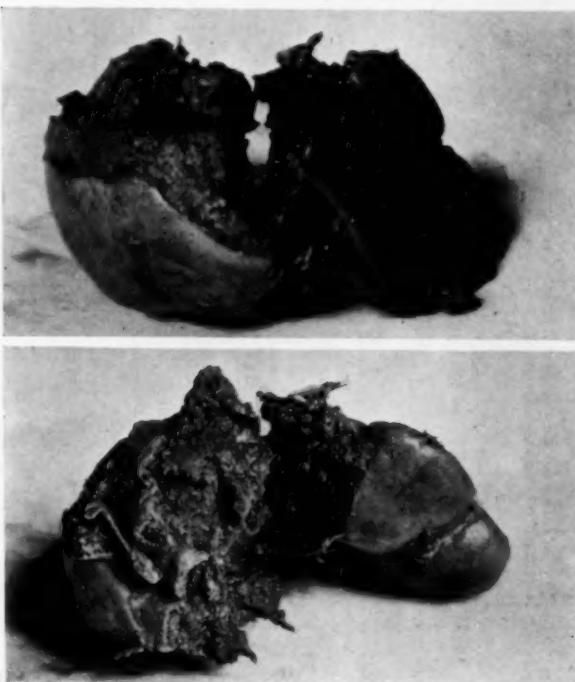


FIG. 1.—Ruptured spleen.

WILLIAM DEP. INLOW

SYNOPSIS OF REPORTED CASES OF TRAUMATIC ABSCESS OF SPLEEN.

*Group I. Injury More or Less Limited to Splenic Area.*

Case No.	Injury	Chief clinical data	Operation	Necropsy	Result
1 Fahner (Mayer)	Fell from ladder striking left side	Young man. Immediate and persistent pain. Later cryptic fever and night sweats. Plaumatic elevation injured area. Symptomless for 2 mos. post-operative when suddenly vomited large amount of pus and died	Incision with evacuation of 12 ounces foul smelling pus	Spleen three times normal size, adherent to stomach, cartilaginous in consistency. Abscess cavity in spleen opening into stomach	Death in two mos. plus.
2 Gockelius (Mayer)	Struck in left hypochondrium by iron knob of walking stick	Baker. Marked pain area of injury. Anorexia. Finally developed a swelling of abdomen similar to an ascites		Large and deep slough in spleen corresponding to size of head of cane. Large amount of foul smelling material in peritoneal cavity	Death.
3 Jacquinelle (Mayer)	Fall	Pain left hypochondrium. Before death dark foul smelling pus evacuated with stool		Spleen enlarged, adherent to colon, containing abscess communicating with gut	Death.
4 Sanger (Tillmans)	Painted and fell in room striking left side	Cook. 26 yrs. old. Ill 35 days		Contusion of spleen with perisplenic abscess. Perforation into pleura, terminal perforation into stomach and duodenum	Death in 4½ mos.
5 Otis (Küttner)	Left side struck by rolling cannon ball	Soldier. Able to wander several miles after injury. Increasing swelling of abdomen.		Large abscess cavity diaphragm to iliac region. Perforation of diaphragm. Spleen in two pieces, contused, floating in abscess	Death in 43 days.
6 Jaffé (Küttner)	Run over by vehicle	Coachman. 24 yrs. old. Splenic enlargement with tenderness. After 8 days pain, fever, left-sided pleuritis. Two aspirations of subphrenic abscess—3,000 c.c. brown fluid. Generalized peritonitis		Diffuse peritonitis, 500 c.c. serous exudate left pleural cavity. Abscess cavity limited by diaphragm, colon, and abdominal wall. Spleen contused, swollen, soft in upper part of cavity	Death in 13 days.

## TRAUMATIC ABSCESS OF THE SPLEEN

			Recovery?	
7 Lampe (Trapp)	Lifted heavy object	Male 30 yrs. old. Panaritium short time before. Stabbing pain splenic region. Later serous and purulent exudate removed from left pleural cavity. Convalescence prolonged after operation	Resection 9th rib. Serous pleural exudate evacuated. Diaphragm bulged by sub-splenic collection. Resection 11th rib. Pus containing many pieces of splenic tissue	Resection 10th rib. Abscess cavity size of two fists containing stinking pus. Free pieces of necrotic spleen
8 Scheyer	Struck in left side by wagon tongue	Blacksmith 60 yrs. old. Chronic endocarditis and several previous chest infections. Gradual decline after injury. Cachectic, weak, pain left chest. Aspiration small amount foul smelling fluid. X-ray—high diaphragm with air bubble	Resection 10th rib. Abscess cavity size of two fists containing stinking pus. Free pieces of necrotic spleen	Gangrenous areas I. 1. lobe of lung. Abscess splenic area, small portions of spleen still present. Terminal perforation into stomach
9 Anis (Scheyer)	Blow of fist against left lower ribs	Male. Malaria spleen. Within a month development of large perisplenic abscess	Laparotomy with evacuation of pus. In abscess cavity large free splenic sequestrum	Perforation with acute peritonitis. Diffuse splenic necrosis with secondary suppuration
10 Vulpius (Scheyer)	Mishandled by husband—left a b o m e n stepped on	Female 42 yrs. old. Transient pain left hypochondrium	Incision into abscess cavity from which the larger portion of the spleen, necrotic, was removed 5 wks. later	Death in 3 mos.
11 Silberstein (Edler)	Severe sneezing following gripe	Previous splenic tumor present. Immediate pain in left hypochondrium, fever, and gradual development of swelling and prominence left chest wall. Questionable case—abscess may have been secondary to gripe and sneezing of no moment	Incision region of 10th rib with evacuation of large amount of pus	Recovery.
<b>Group II. Injury Splenic Region Associated With Other Injuries.</b>				
12 Göhde (Mayer)	Gunshot wound	Soldier. Fracture of left radius. Superficial tunnelling of left side of body with fracture of 12th rib. Forty-seven days later anorexia, fever, tenderness splenic region. Six days later sudden symptoms of diffuse peritonitis	12th Rib and radius healed with solid callus. Erosion outer surface spleen, several abscesses in substance of organ. One abscess perforated into peritoneum. Peritonitis	Death in 54 days.
13 Trapp	Knocked off wagon by limb of tree. Run over	Unconscious 5-6 hrs. Contusion l. temporal region. R. haemothorax, possible rib fracture. Developed icterus from possible rupture of liver, then a severe general furunculosis. Persistent fever. 52nd day aspiration of l. pleural effusion. 2 wks. later 2nd aspiration—pus with streptococci. Gradual decline following operation	Sixty-seventh day resection of 10th rib. Incision into abscess cavity of two fists filled with pus and necrotic tissue. Drainage	Abscess cavity between spleen and diaphragm walled-off from abdominal cavity by adhesions. Necrotic splenic tissue in abscess. Larger portion of spleen, however, intact

WILLIAM DEP. INLOW

SYNOPSIS OF REPORTED CASES OF TRAUMATIC ABSCESS OF SPLEEN.

*Group II: Injury Splenic Region Associated With Other Injuries.—Continued*

Case No.	Injury	Chief clinical data	Operation	Necropsy	Result
14 Karewski (Küttner)	Caught between wagon and side of gateway	Maiden 12 yrs. old. Unconscious. Awoke with vomiting and in severe shock. Fracture rt. clavicle. Symptoms of diffuse peritonitis. After 14 days seemed well. Became ill again with fever. Dullness lower thorax with resistance left rib margin. Aspiration—foul smelling pus	Resection 10th rib. Diaphragm bulged against costal pleura. Incision with evacuation of pus. Spleen present as complete sequestrum, removed without bleeding		Recovery.
15 Phücker- Bardenhauer (Küttner)	Fell 4 meters into cellar	Shock. Fracture 6th and 7th ribs on left. Pain cardiac region. Next day dullness left abdomen to axilla. Eleventh day severe pain in abdomen, dyspnea, continual rise in temperature, tenderness and dullness under xiphoid	Resection lower two ribs. Cavity size of child's head filled with coagulated blood. In middle of cavity lay the spleen twice normal size with the capsule torn in various places. Spleen torn from its pedicle without bleeding		Recovery.
16 Weichert	Fell 12 meters from roof	Abrasions left side. Right hand luxated, ulna protruding, radius fractured. Infestation of wound, resection of ends of bones with packing. Gradually localized pains splenic region with flatness. Blood culture neg. Sudden peritonitis		Rupture of splenic capsule with escape of blood into peritoneal cavity. Purulent peritonitis. Streptococcus pyogenes in pus from peritoneum and from arm	Death in 14 days.
<i>Group III. Injury With Symptoms Indicating Early Operation.</i>					
17 (Berger)	Run over by vehicle	Young man. Symptoms of peritonitis involvement. Laparotomy. Much blood in abdomen from a ruptured spleen. Splenectomy. Development of a subphrenic abscess			Death in 3 wks.
18 Krienkow (Berger)	Beaten by husband	Female 31 yrs. old. Peritonitis and ascites. Laparotomy after 4 hrs. Evacuation of much blood, tamponade of rupture in spleen. Removal of diseased uterine adnexa. Seven days later opening of pelvic abscess per vaginam			Recovery?

## TRAUMATIC ABSCESS OF THE SPLEEN

			Recovery in 2½ mos.
19 Krienkow (Berger)	Shot in 6th intercostal space	Operation in 3 hrs. Wound enlarged. Left pleura and diaphragm shot through. Closure. Laparotomy. Evacuation of much blood. Spleen shot through. Tamponade	Resection of 10th rib 10 days later. Evacuation of sub-diaphragmatic abscess. Four subsequent aspirations of effusion in left chest
		<i>Group IV. Latent Cases.</i>	
20 Henning (Mayer)	Fall injuring left side	Young woman. Cachectic. After several years ill without preceding incident. Pain in splenic region, no tumor palpable. Unable to walk or sit, or to breathe deeply when straightened out. Sudden sensation of something tearing inside. Vomiting of pus; likewise large amount of pus in urine for several days	Recovery.
21 Kerkring (Mayer)	Skating. Fell striking left hypochondrium on stone	Maiden 19 yrs. old. Marked pain which disappeared in 12 days. No further symptoms save heavy feeling in splenic region at menses and on marked bodily movement. After three years sudden rupture and emptying of abscess by vomiting and diarrhea	Recovery.
22 Omi	Blow of fist left costal margin	Male, 27 yrs. Had had malaria 7 yrs. Pain and swelling after injury. A year later cachectic, upper abdomen bulging, tenderness and questionable fluctuation left hypochondrium. Smooth convalescence post-operative for 4 mos. when following a dietary indiscretion died of peritonitis from perforation of small remaining pus focus	Fistulous tract from abdominal incision to spleen. Spleen adherent on all sides, deformed by a large defect from upper pole to hilus  Death in 1 yr. 4 mos.
23 Bogdanik	Horse kick left side.	A year later pain left chest and abdomen. Abdomen distended and tense. Tender round body palpable which extended from right mamillary to left axillary line	Left rectus incision. Glistening, steel colored, fluctuant tumor. Incision with evacuation of about 1 litre of pus, green and odorless. Spleen sewed to abdominal wall. Tamponade  Recovery.

## WILLIAM DEP. INLOW

temperature, ranging from 99° to 101° in the mornings, and from 101° to 103° in the afternoons, the average temperature range being from about 100° in the morning to 102° in the afternoon. The amount of infection in the area of the fracture seemed insufficient to explain the temperature course. No abnormal findings could be made out in chest or abdomen. The leukocyte count was not high, running persistently about 10,000.

On the afternoon of the eighteenth day he experienced pain in the anterior left side of the chest and felt that the precordial region had "filled up" so that he could scarcely get his breath. He was very dyspneic and had a few attacks of coughing with the expectoration of a frothy non-purulent sputum streaked with blood. On examination there was little respiratory excursion of the left chest, the anterior portion of which was hyperresonant. The next morning the hyperresonance was still noted and it was difficult to outline the cardiac dullness. The posterior left part of the chest was now almost flat to percussion up to the interscapular region, and the breath sounds at the base of the lung were diminished. Thoracentesis in two different areas was ineffectual. The following day he complained of pain on the right, running from the right half of the neck obliquely through the right side of the chest to its base. He felt better and could breathe better lying on his right side. He was dyspneic, coughed up bloody sputum, and had the appearance of a patient with pneumonia. There were now indications of consolidation of the right lower lobe posteriorly with a pleural friction rub. The leukocyte count was 22,000. Death occurred the next morning, three weeks after injury.

*Necropsy.*—At post-mortem examination there were about 100 c.c. of serosanguineous fluid in the peritoneal cavity, and adhesions in the left hypochondrium involving the whole of the spleen, the cardia, lateral and posterior upper left abdominal wall, and the left diaphragm. The spleen was severely contused and friable in its upper pole anteriorly with a fissure running from the anterior border at the middle to the hilus (Fig. 1). It weighed 195 gms. Between the spleen and the diaphragm there was a small abscess with a definite abscess wall, containing about 30 c.c. of pus and old blood together with several small pieces of necrotic tissue. There were adhesions in the pelvis with matting together of loops of the small intestine. The anterior mediastinal tissues were emphysematous and oedematous. About 200 c.c. of serosanguineous fluid with flakes of fibrin were found in the right pleural cavity. The right lower lobe itself was semisolid and its pleural surface covered with fibrinous exudate. There were about 200 c.c. of fluid, not so bloody as that on the right, in the left pleural cavity. From the region of the sixth rib in the midaxillary line the diaphragm was adherent to the chest wall; the sixth rib was fractured. The left lower lobe of the lung was solid and resembled hepatic tissue on cross-section. The wound of the left arm was clean. There was complete mobility at the area of fracture with little formation of callus.

### SUMMARY

Traumatic abscess of the spleen is rare, but twenty-three cases being found in the available literature. These and a personal case are reported. The condition is the result of injury to the splenic region with contusion or rupture of the spleen. Secondary infection of haematomas and contused tissues leads to the formation of abscess. Separation of necrotic masses often gives splenic sequestra.

The course may be conveniently divided into three stages: (1) stage of initial injury; (2) intermediate or cryptic stage; (3) terminal stage or stage of extension or rupture.

The cases fall into four groups: (1) in which injury is more or less limited to the splenic area; (2) in which injury to the splenic area is asso-

## TRAUMATIC ABSCESS OF THE SPLEEN

ciated with other injuries; (3) in which injury is associated with symptoms indicating early operation; and (4) in which the cases are latent.

Diagnosis may be difficult. Many cases have been recognized only following rupture or at operation or necropsy. The treatment is surgical. The prognosis is grave. The mortality has been 58 per cent. The mortality of patients operated on was 38 per cent.; of medical patients (excluding latent cases) 100 per cent.

Earlier diagnosis with timely intervention should improve these results.

## BIBLIOGRAPHY

- <sup>1</sup>Berger, Erich: Die Verletzungen der Milz und ihre chirurgische Behandlung. Arch. f. klin. Chir., 1902, vol. Ixviii, pp. 768-816, 865-914.
- <sup>2</sup>Bessel-Hagen, F.: Ein Beitrag zur Milzchirurgie. Arch. f. klin. Chir., 1900, vol. Ixii, pp. 188-231.
- <sup>3</sup>Bogdanik, J.: Traumatischer Milzabszess. Berl. klin. therap. Wchnschr., 1905, vol. ii, pp. 7-9.
- <sup>4</sup>Edler, L.: Die traumatischen Verletzungen der parenchymatösen Unterleibsorgane. Arch. f. klin. Chir., 1887, vol. xxxiv, pp. 573-620.
- <sup>5</sup>Elting, A. W.: Abscess of the Spleen. ANNALS OF SURGERY, 1915, vol. lxii, pp. 182-192.
- <sup>6</sup>Grand-Moursel, P. E.: Contribution a l'étude des abcès de la rate. Paris, Thesis, 1885, 47 pp.
- <sup>7</sup>Küttner, Hermann: Ueber sequestrierende Milzabzesse. Beitr. z. klin. Chir., 1907, vol. liv, pp. 405-457.
- <sup>8</sup>Lenormant, C., and Sénèque, J.: Les abcès de la rate. Jour. d. chir., 1923, vol. xxi, pp. 685-698.
- <sup>9</sup>Mayer, Ludwig: Die Wunden der Milz. Leipzig, F. C. W. Vogel, 1878.
- <sup>10</sup>Omi, K.: Ueber traumatische Milznekrose mit perisplenitischen Abszess. Beitr. z. klin. Chir., 1906, vol. li, pp. 359-367.
- <sup>11</sup>Scheyer, K.: Ueber sequestrierenden Milzabszess. Beitr. z. klin. Chir., 1924, vol. cxxxii, pp. 225-241.
- <sup>12</sup>Tédenat: Abcès de la rate. Rev. d. Gynec. et de Chir. Abdom., 1901, vol. v, pp. 622-632.
- <sup>13</sup>Tillmann, H.: Ueber die Communicationen des Magen-Darmcanales mit der Brusthöhle und über subphrenische Kothabszesse. Arch. f. klin. Chir., 1881, vol. xxvii, pp. 103-161.
- <sup>14</sup>Trapp: Zur Kenntniss der Verletzung der Unterleibsorgane (Zwerchfell, Milz, Leber) durch stumpfe Gewalt. Deutsch. Ztschr. f. Chir., 1897, vol. xliv, pp. 393-408.
- <sup>15</sup>Weichert: Vereiterung eines Milzhämatoms nach infizierter komplizierter Vorderarmfraktur. Berl. klin. Wchnschr., 1911, vol. xlviii, pp. 1157-1158.
- <sup>16</sup>Wildegans: Zur Pathologie und Therapie des Milzabszesses. Arch. f. klin. Chir., 1920, vol. cxiv, pp. 416-442.

## DUODENITIS \*

BY E. STARR JUDD, M.D.

AND

GUNTHER W. NAGEL, M.D.

OF ROCHESTER, MINN.

FROM THE DIVISION OF SURGERY, MAYO CLINIC

THE problem of peptic ulcer has not been solved. Although the diagnosis of this type of ulcer can be made with a high degree of accuracy, the treatment is not as yet on a uniform and absolutely sound basis. In spite of many theories, the origin of peptic ulcer remains unknown. Our knowledge of the pathology of duodenal ulcer has been advanced in recent years by the study of tissues removed at operation; such study has demonstrated the occurrence of an inflammatory lesion which we call duodenitis. The term duodenitis has been more or less arbitrarily limited to a type of chronic inflammation of the duodenum without calloused ulcers, the clinical picture of which is practically identical with that of chronic duodenal ulcer. The cause of the disease is unknown. The pathologic findings are distinctive. The association between duodenitis and chronic ulcer of the duodenum is probably close, but the exact relationship of the two lesions is not known. Gastritis and jejunitis are pathological and surgical entities and probably bear the same relationship



FIG. 1.—Gross appearance of true duodenal ulcer.

to gastric ulcer and jejunal ulcer as duodenitis does to duodenal ulcer.

W. J. Mayo was among the first to recognize that duodenal ulcer exists in two forms, the indurated calloused ulcer which can be seen and felt from the serosal surface, and the non-indurated ulcer which cannot be seen from the outside, cannot be palpated, and is, indeed, recognized with difficulty even with the intestine open, since its site is sometimes marked by only a minute abrasion of the mucosa. This is the so-called clinical ulcer, to which the early failures in the surgical treatment of peptic ulcer were largely attributed.

Some years ago, we called attention to two distinct pathologic lesions in the duodenum, either of which may occur when there is a characteristic history of chronic peptic ulcer. The first is the true ulcer, which is recognized by the congestion and stippling of the serosal surface with more or less scar tissue, and adhesions and deformity of the duodenum. The wall of the

\* Read before the Southern Surgical Association, December 14, 1926.

## DUODENITIS

bowel is always indurated and a tumor may form as a result of the defensive reaction of the surrounding tissues, if the ulcer has perforated the bowel slowly. When the intestine is open a crater ulcer is seen. (Figs. 1 and 2.) The second type of lesion, which we have called duodenitis or submucous ulcer, is characterized by congestion and stippling of the serosa with little or no induration. Palpation of the duodenum is negative and when the bowel is opened no lesion of the mucosa can be found, or at most, only one or more small superficial mucosal abrasions. (Figs. 3 and 4.) These might be considered healed ulcers were it not that the congestion, edema, stippling, and the presence of symptoms constitute evidence of a pathologic process going on in the wall of the intestine. Microscopic examination reveals little or no abrasion of the mucosa, but the submucosa, and sometimes the muscle layers, are infiltrated with lymphocytes. Often there is a tendency to circular constriction of the bowel, but it is difficult to determine whether this is due to spasm or true narrowing. Clinically there is little, if any difference between the two types. The röntgenogram shows spasmodic deformity in both lesions.

That duodenitis is not a stage from which true ulceration invariably develops is shown by the fact that the average duration of symptoms of the two lesions is about the same. The terminology has no bearing on the clinical diagnosis or treatment.

MacCarty has reviewed ninety-seven excised, localized, inflammatory duodenal areas and has found that the pathologic picture of duodenitis is cellular destruction with congestion, edema and migration of polymorphonuclear leucocytes, lymphocytes, and endothelial leucocytes. The lesion may be localized or diffuse.



FIG. 3.—Gross appearance of duodenitis.

The recently advocated treatment of duodenal ulcer by extensive resection of the first portion of the duodenum and pyloric portion of the stomach has led to interesting pathologic findings. Konjetzny, Orator, Puhl and others note that in nearly all cases of gastric and duodenal ulcer there is more or less extensive gastritis and duodenitis.



FIG. 2.—True duodenal ulcer, showing crater (x9).

Konjetzny observed it in twenty-two cases of duodenal ulcer. Grossly there are wart-like papillary outgrowths of epithelium together with thinned-out atrophic areas. All stages of superficial ulceration are seen, from tiny abrasions to fissures and ulcers of appreciable size. These lesions are covered with fibrinous exudate.

Microscopically, inflammatory changes are seen in the mucosa which is oedematous and infiltrated with polymorphonuclear leucocytes and lymphocytes. The epithelium is denuded in places and in others it has regenerated. In areas where the epithelium is denuded, exudate streams from the mucosa like smoke from a funnel. This exudate is largely fibrinous and rich in cells, chiefly polymorphonuclear leucocytes, but also lymphocytes and plasma cells. Areas of acute polymorphonuclear infiltration occur with more chronic areas characterized by a predominance of lymphocytic cells. Often the lower layers of the mucosa are eroded, although there is no epithelial defect. Except where a chronic



FIG. 4.—Duodenitis showing the intact mucosa (x50).

ulcer appears, the process is limited as a rule to the mucosa, although the submucosa in some instances shares in the inflammatory reaction.

The pathologic findings in duodenitis call attention to the work of Rosenow, as the lesions closely resemble those produced by him in animals by injecting specific strains of streptococci. Rosenow has recovered these strains from the tonsils and infected teeth in patients with ulcer of the stomach or duodenum, and also from inflammatory duodenal tissue removed at operation.

In Table I is a summary of twenty-six cases of duodenitis. Fourteen patients were women and twelve were men. This differs from the usual ratio in chronic peptic ulcer in which the number of men is greater. The oldest patient was sixty-seven and the youngest twenty-seven. The average age of the women was forty-five and that of men thirty-nine. The average age of the men and women considered together was forty-two. The longest period of symptoms was thirty-five years, the shortest one year, the average eleven years. In twenty-two cases the history was typical of duodenal ulcer and in four it was not typical. In one case there was a history of jaundice,

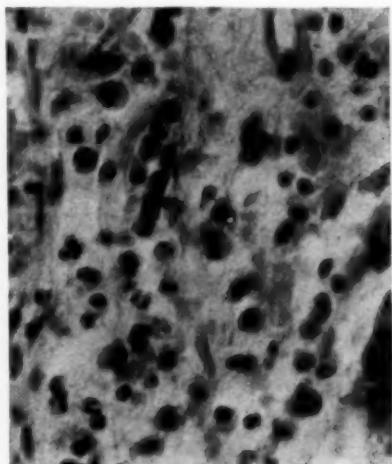


FIG. 5.—Polymorphonuclear infiltration in duodenal mucosa (x300).

## DUODENITIS

### *Summary of Cases of Duodenitis*

Case	Sex	Age (years)	Duration of symptoms (years)	Hemorrhage	Röntgenogram	Duodenal ulcer	Negative	Acid		Excision	Excision and plastic operation	Appendectomy	Cholecystectomy	Cure	Great relief	Failure	Remarks
								Total	Free								
1 F 51 11 +					+			20	0	+							
2 M 66 1					+			72	56	+							
3 M 40 6					+			34	20	+							
4 M 43 20 +					+			48	30	+							
5 M 28 10							+	42	34	+							
6 F 48 5					+			30	12	+							
7 F 39 1										+							
8 M 46 3					+			82	74	+							
9 M 27 3					+			56	38	+							
10 M 28 8					+			80	60	+							
11 F 44 5					+			48	28	+							
12 F 57 10					+			46	30	+							
13 M 34 15				Gastro-jejunal ulcer				42	36	+							
14 F 38 24 +						+		70	50		+	+	+				
15 F 27 10					+			66	48		+	+					
16 F 50 13					+				40		+	+					
17 F 41 20					+			70	50		+	+					
18 F 41 20					+			94	74		+	+					
19 M 42 7 +					+						+	+					
20 F 67 35 +					+			110	90		+	+				+ Died.	
21 F 35 10								50	30		+	+	+				Post-operative phlebitis.
22 M 46 14					+			80	60		+	+					
23 F 34 15 +					+			82	68		+	+					
24 M 33 10					+			74	54		+	+	+				
25 M 38 14					+			80	60		+	+					
26 F 51 3				Complete obstruction				74	50		+	+	+				

but only duodenitis was found at operation. In one case typical gall-bladder colic had occurred, and at operation duodenitis and a diseased gall-bladder were seen; the gall-bladder was removed. A history of hemorrhage was obtained in six cases (23 per cent.). In seven cases operation had been performed, in four appendectomy, in two gastro-enterostomy, and in one appendectomy, gastro-enterostomy and hysterectomy. Duodenal ulcer was diagnosed röntgenographically in twenty-two cases and gastrojejunal ulcer in one case. In two cases röntgenograms were negative and in one none was made. In one case only was there röntgenologic evidence of obstruction. The gastric analysis showed an average total acidity of 63 and an average free hydrochloric acid content of 46. The highest reported total acidity was 110 and the lowest 30; the highest free hydrochloric acid was 90 and the lowest zero. Three

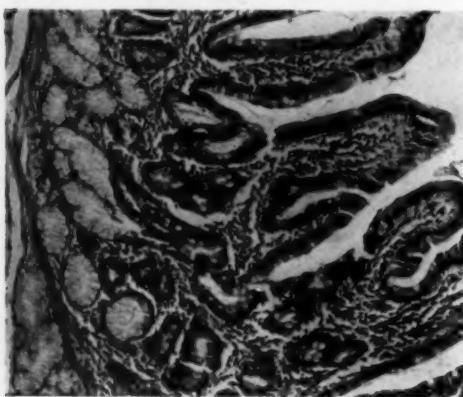


FIG. 6.—Appearance of normal duodenum.

types of operation were performed on the duodenum. In all cases the diseased area was excised; in eight simple excision was carried out; in five excision was combined with transverse sectioning of the pylorus, and in thirteen a portion of the anterior part of the sphincter was excised together with the inflammatory area, and gastroduodenostomy performed. Appendectomy also was performed in sixteen cases, cholecystectomy in three, and a gastro-enteric anastomosis was undone in one case. The convalescence of most of the patients was remarkably smooth. One developed mild bronchitis and another slight thrombophlebitis. One died five days after operation, the immediate cause of death being toxæmia and acidosis of unknown origin. At necropsy the operative wound was in good condition, but carcinoma was found in the body of the pancreas. There are authentic reports concerning eighteen patients, including the one who died. Of these, fifteen (83 per cent.) are cured or greatly benefited, while two (11 per cent.) report slight benefit as a result of the operation, a total of seventeen patients (94 per cent.) who are benefited by the operative procedure.

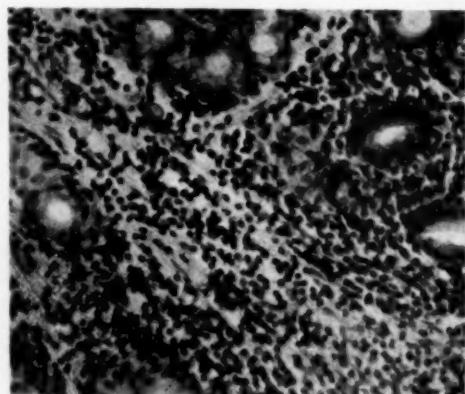


FIG. 7.—Lymphocytic infiltration in submucosa (x120).

## DUODENITIS

*Discussion.*—Duodenitis like other tissue reactions varies in degree. The simplest form is seen at operation as a slight area of hyperæmia and faint stippling when the serosa is rubbed, the area involved usually being a circular patch 2 or 3 cm. in diameter on the anterior surface of the duodenum just below the pylorus. The affected area may be cedematous and the serosal surface slightly dulled. In this simple form there is no deformity of the duodenum, but there may be slight pylorospasm. In the more advanced forms the area is red, hyperæmic and oedematous, and the stippling is marked. In a still later stage the duodenum is uniformly narrowed for a distance of several centimetres, and in extreme cases the circumference of the area is not more than 2 or 3 cm. In advanced cases there may be deformity of the duodenum, but no stellate scars, irregular contractions or punched-out lesions are seen in duodenitis. There may be adhesions of the omentum and gall-bladder or other organs to the lesion, but these are usually slight and easily separated. Dense adhesions and tumor such as are sometimes observed in cases of chronic perforating ulcer are not found. When the area is excised the mucosa is usually found intact, although in some

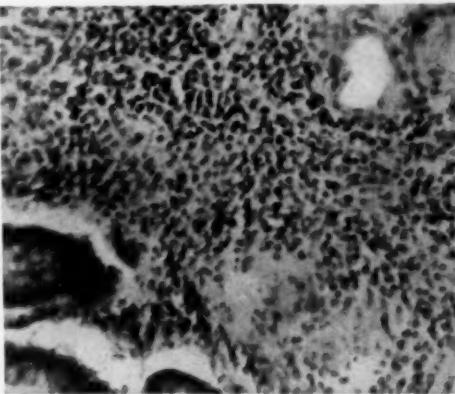


FIG. 8.—Lymphocytic infiltration of mucosa and submucosa (x120).

instances there may be single or multiple small superficial abrasions. The wall of the bowel is generally somewhat thicker than normal. Duodenitis is not necessarily progressive in all cases. In some cases the inflammation is mild at operation in spite of a long duration of symptoms. In other cases in which the history is comparatively short, the pathologic changes are extensive. In each case also there are undoubtedly periods of exacerbation and remission of the disease

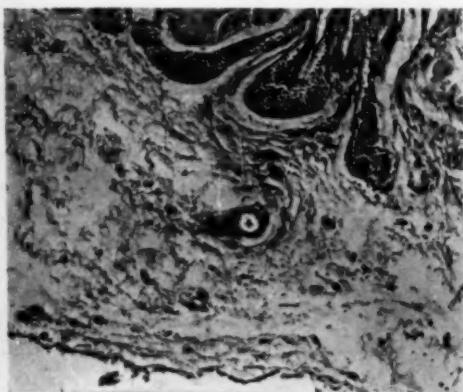


FIG. 9.—Oedematous and congested serosa (x60).

probably coincident with the occurrence of symptoms and freedom from them.

Careful search in cases of duodenitis fails to show any evidence of chronic ulceration. In studying duodenums obtained at necropsy, we have found scars of varying size and thickness, indicating that ulcers had occurred at a previous time. In some instances the scar tissue could only be seen microscopically, and in these cases the old ulcers were evidently very superficial.

Chronic ulcers in healing leave marks varying from this minute form to the firm calloused scar involving all thicknesses of the wall of the bowel. Small acute ulcers and the superficial erosions occasionally seen in duodenitis involve the mucosal layer alone, and these heal without leaving a macroscopic scar. Chronic ulcers which have penetrated beyond the muscularis mucosæ always leave a scar. In duodenitis there is nearly always slight stippling on the posterior surface of the duodenum opposite the affected area; this, however, is never the result of true chronic ulceration, as the mucosa over the inflamed area is intact and no thickening or induration is felt on palpation.

In a microscopic section of the affected area are seen all the changes of subacute and chronic inflammatory processes.

The epithelium is generally intact but may be denuded in a few small areas, in which case epithelial cells are seen in various stages of degeneration, and the surface is covered with fibrinous exudate rich in lymphocytes, plasma cells and occasional eosinophiles. In areas in which inflammation is more acute, a fair sprinkling of polymorphonuclear leucocytes is found. (Fig. 5.) In most instances the mucosa and submucosa are affected and occasionally, the cellular infiltration



FIG. 10.—Röntgenologic diagnosis, duodenal ulcer with incisura; pathologic diagnosis, duodenitis.

extends through the muscle layers to the serosa. (Figs. 6, 7 and 8.) There may be a perceptible increase in fibrous tissue, especially in the submucosa. Also the vessels of the submucosa show some engorgement, but this is most marked in the serosa which is generally congested and thickened. (Fig. 9.)

European observers have found extensive gastritis in specimens resected for duodenal ulcer. We have limited the treatment of duodenal ulcer to gastro-enterostomy or local excision, and the stomach has not been studied pathologically. However, our observations lead us to believe that inflammation is, as a rule, fairly well limited to the first portion of the duodenum and the pyloric end of the stomach. We have, however, seen cases in which nearly the entire stomach as well as the duodenum appeared to be congested, edematous and inflamed. Possibly it is in this type of case that extensive

## DUODENITIS

gastric resection should be performed. In stomachs resected for gastric ulcer we have found widespread gastritis which resembles duodenitis in all its details.

The problem of jejunal ulcer has always been a difficult one and here also an inflammatory lesion appears to play a part. We have operated in twelve cases diagnosed as jejunal ulcer, but did not find true ulcer. In such cases the jejunum is thick, distended, friable, red and edematous and the mucosa is covered with tiny hemorrhagic areas. The wall of the stomach is usually greatly hypertrophied and the mucosa thickened and oedematous, but ulcerations, erosions and hemorrhagic areas are not prominent. We are unable to determine the significance of these findings, but just as we have observed cases with histories and Röntgen-ray pictures characteristic of duodenal ulcer in which no true chronic ulcer was found, so also there are cases in which the primary lesion is gastritis or jejunitis.

The exact relationship between duodenitis and chronic ulcer of the duodenum is not clear. Konjetzny and others have shown that in most cases of chronic perforating ulcer of the duodenum, more or less extensive duodenitis is also present. Konjetzny in a single specimen has found all stages from simple cellular infiltration of the mucosa and superficial erosions to large chronic calloused ulcers. Pathologically the lesions are closely related, and according to Konjetzny a chronic ulcer forms as the result of unknown mechanical factors on the basis of chronic duodenitis. The importance of the acid factor is still undetermined. That chronic ulcers do not develop in all cases of duodenitis is probably due to a number of factors which at present cannot be accurately determined.

The clinical picture of duodenitis is practically identical with that of chronic duodenal ulcer. The patient is usually an adult in the third or fourth decade of life who has had periodic attacks of epigastric pain and distress coming on from two to three hours after meals and relieved by food and soda. The spells occur two or more times a year, each lasting from a few



FIG. 11.—Röntgenologic diagnosis, duodenal ulcer with marked spasm of bulb; pathologic diagnosis, duodenitis.

days to several weeks, and are followed by free intervals of weeks or months. Diet relieves temporarily but does not cure the condition. Vomiting is not such a common feature in duodenitis, no doubt because stricture is not as common as in chronic ulceration. Spasm, however, may be marked. The average duration of symptoms in this series was eleven years. The general health of the patients is fair. Focal infection does not appear to be more prevalent than in the general run of cases observed at the Clinic. A history of gastric or intestinal hemorrhage was fairly common (23 per cent.) in this series, more so than in the average series of cases of chronic duodenal ulcer. The congestion and tiny superficial abrasions noted in duodenitis readily

account for the hemorrhages. Physical examination as a rule is negative, although there may be tenderness in the epigastrium. The röntgenographic deformity in duodenitis, according to Carman, is the same as that in duodenal ulcer, except that a niche is never seen in duodenitis. Moore says that the spasm in these cases may be so marked as to pro-

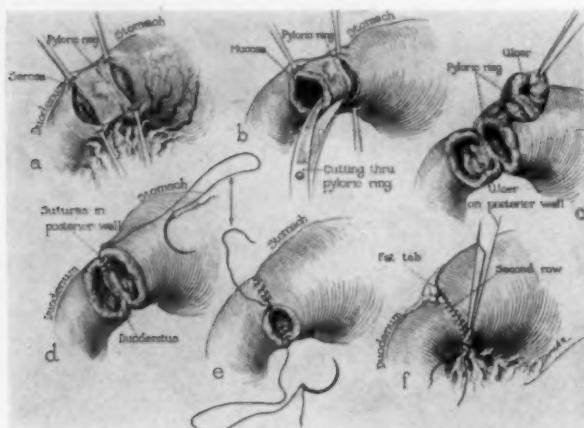


FIG. 12.—Method of performing gastroduodenostomy.

duce a typical hour-glass deformity of the duodenum. (Figs. 10 and 11.) A clinical diagnosis of duodenitis cannot be made and the presence of the lesion can only be determined by careful inspection at operation with the duodenum open and microscopic examination of the diseased tissue.

The most suitable therapeutic procedure in duodenitis is to excise the diseased area together with the anterior half of the pyloric sphincter, bring the cut ends of the stomach and duodenum together over the remaining posterior half of the sphincter and stitch them transversely with two or three rows of chromic catgut and silk. (Fig. 12.) This gives better results than simple excision. We have performed the operation in a large number of cases of duodenitis and duodenal ulcer. The procedure is physiologically and anatomically ideal, in that the diseased area is eliminated and the normal continuity of the bowel maintained. The operation is only suitable for those cases in which the duodenum is sufficiently large and mobile to allow approximation of the tissues without tension. The lesion is usually limited to the cap of the duodenum and can then be excised readily, but there are cases in which the disease is too extensive to permit local excision; in these gastroenterostomy or some other operative procedure must be carried out. Stricture

## DUODENITIS

or spasm of the pylorus does not follow excision by this method because a portion of the pyloric sphincter is removed. The results obtained are excellent, 94 per cent. of the patients being cured or greatly benefited by the operation.

### CONCLUSIONS

1. Duodenitis is a surgical and pathologic entity characterized by circumscribed or diffuse inflammation of the first portion of the duodenum without the formation of chronic ulcer.
2. The clinical picture and röntgenologic data are almost identical with those of chronic duodenal ulcer. No niche is seen in duodenitis.
3. The association between duodenitis and chronic duodenal ulcer is close. All chronic ulcers probably originate from duodenitis. The reason why duodenitis is not always followed by chronic ulceration has not been determined.
4. Gastritis and jejunitis are surgical and pathological entities, the full significance of which is not known.

### BIBLIOGRAPHY

<sup>1</sup> Aschoff, L.: Ueber die mechanischen Momente in der Pathogenese des runden Magengeschwürs und über seine Beziehungen zum Krebs. *Deutsch. med. Wehnschr.*, 1912, vol. i, pp. 494-496.

<sup>2</sup> Aschoff, L.: *Pathologische Anatomie*. Jena, Fischer, 1921, 591 pp.

<sup>3</sup> Carman, R. D.: Discussion. *Jour. Am. Med. Assn.*, 1924, vol. lxxxiii, 1897.

<sup>4</sup> Judd, E. S.: Pathologic Conditions of the Duodenum. *Journal-Lancet*, 1921, vol. xli, pp. 215-220.

<sup>5</sup> Judd, E. S.: Excision of Ulcer of the Duodenum. *Journal-Lancet*, 1922, vol. xlvi, pp. 381-385.

<sup>6</sup> Judd, E. S., and Nagel, G. W.: Excision of Ulcer of the Duodenum. *Surg., Gynec. and Obst.*, 1926. (In Press.)

<sup>7</sup> Konjetzny, G. E.: Zur Pathologie und chirurgischen Behandlung des Ulcus duodeni. *Deutsch. Ztschr. f. Chir.*, 1924, vol. clxxxiv, pp. 85-104.

<sup>8</sup> Konjetzny, G. E.: Ueber die Bedeutung der Gastritis und Duodenitis für die Pathogenese des Magenduodenalgeschwürs. *Verhandl. d. deutsch. path. Gesellsch.*, 1925, vol. xx, pp. 165-172.

<sup>9</sup> Konjetzny, G. E.: Entzündliche Genese des Magen-Duodenalgeschwürs. *Arch. f. Verdauungskr.*, 1925, vol. xxxvi, pp. 189-226.

<sup>10</sup> MacCarty, W. C.: Excised Duodenal Ulcers. A Report of Four Hundred Twenty-five Specimens. *Jour. Am. Med. Assn.*, 1924, vol. lxxxiii, pp. 1894-1898.

<sup>11</sup> Mayo, W. J.: The Contributions of Surgery to a Better Understanding of Gastric and Duodenal Ulcer. *ANNALS OF SURGERY*, 1907, vol. xlvi, pp. 810-817.

<sup>12</sup> Mayo, W. J.: Ulcer of the Stomach and Duodenum with Special Reference to the End Results. *ANNALS OF SURGERY*, 1911, vol. liv, pp. 313-320.

<sup>13</sup> Mayo, W. J.: Pathologic Data Obtained from Ulcers Excised from the Anterior Wall of the Duodenum. *ANNALS OF SURGERY*, 1913, vol. lvii, pp. 691-694.

<sup>14</sup> Mayo, W. J.: Progress in the Handling of Peptic Ulcer. *Jour. Am. Med. Assn.*, 1922, vol. lxxix, pp. 19-22.

<sup>15</sup> Moore, A. B.: Personal Communication.

JUDD AND NAGEL

- <sup>16</sup> Orator, V.: Beiträge zur Magenpathologie (histologische Untersuchungen an klinischen Resektionsmaterial). I. Das Magen-Duodenal- und postoperative Jejunumgeschwür. *Virchow's Arch. f. path. Anat.*, 1925, vol. ccxxv, pp. 639-676.
- <sup>17</sup> Puhl, H.: Über die Bedeutung entzündlicher Prozesse für die Entstehung des Ulcus ventriculi et duodeni. *Virchow's Arch. f. path. Anat.*, 1926, vol. cclx, pp. 1-109.
- <sup>18</sup> Rosenow, E. C.: The Production of Ulcer of the Stomach by Injection of Streptococci. *Jour. Am. Med. Assn.*, 1913, vol. lxi, pp. 1947-1950.
- <sup>19</sup> Rosenow, E. C.: Pathogenesis of Spontaneous and Experimental Appendicitis, Ulcer of the Stomach and Cholecystitis. *Jour. Indiana State Med. Assn.*, 1915, vol. viii, pp. 459-460.
- <sup>20</sup> Rosenow, E. C.: The Causation of Gastric and Duodenal Ulcer by Streptococci. *Jour. Infect. Dis.*, 1916, vol. xix, pp. 333-384.

## USE OF APPENDIX VERMIFORMIS IN THE FORMATION OF A URETHRA IN HYPOSPADIA \*

BY STUART McGUIRE, M.D.  
OF RICHMOND, VA.

DURING an early period of my professional career my father turned over to me a case of hypospadias. I was young, enthusiastic and eager to undertake any surgical adventure, hence I did not question his disinterestedness, but was gratified by the favor I thought he had conferred upon me. I studied the literature of subject and decided to follow the plan of treatment described in *Treves' System of Operative Surgery*, the recognized authority of that day.

The patient was fortunately the son of well-to-do and confiding parents. First and last, I operated on him seventeen times during a period which covered over five years. Eventually I secured a remarkably satisfactory anatomical and functional result. This was proved by the fact that the boy contracted gonorrhoea during his years of indiscretion, and became the father of four children after a marriage in later life.

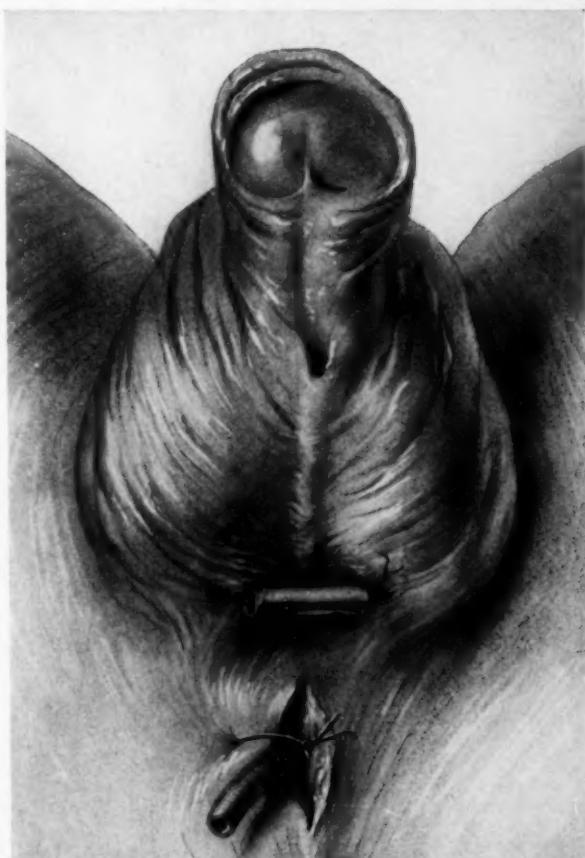


FIG. 1.—Perineal drainage preliminary to plastic operation.  
Occlusion of urethra anterior to opening by encircling ligature.—  
Re-drawn from Young.

Since this first case of hypospadias I have had others. They have come in bunches with intervals between, during which I recovered my courage sufficiently to undertake the new cases. I never expected to write a paper on hypospadias, and my only purpose now is to call attention to a rather

\* Read before the Southern Surgical Association, December 14, 1926.

STUART McGUIRE

novel method of forming a new urethra which I have employed successfully in three cases. The method is new to me, although it may have been used before by other operators.†

Those who desire to make a thorough study of hypospadias are referred

to the contributions of two Fellows of this Association, one by James E. Thompson, of Galveston, published in the Transactions for 1916, and the other by Hugh H. Young, of Baltimore, printed in his *Practice of Urology*.

Before undertaking a case, it is very important for the surgeon to have a frank talk with the family of the patient, and explain the time it will probably take, and the number of operations that may be necessary, to correct the abnormal condition present. They may be assured of the safety of the surgical undertaking and the probability of a satisfactory final result, but they should be told of the likelihood of frequent partial failures before ultimate success is attained. An ounce of warning is worth more than a pound of explaining.



FIG. 2.—Perineal urethrostomy for drainage without tube.—Redrawn from Young.

for the operative procedure is between the seventh and fourteenth year. If the work is undertaken too early the parts are so small and the tissues so

† I have since found that in a paper published in *ANNALS OF SURGERY* for April, 1919, entitled "Transplantation of the Vermiform Appendix into the Female Bladder to Supply an Absent Urethra," Dr. Charles M. Rosser of Dallas, Texas, suggested the use of the appendix in the cure of hypo- and epi-spadia.

#### FORMATION OF URETHRA IN HYPOSPADIA

delicate that plastic operations are difficult. In addition it is impossible to secure the coöperation of the little patient, as he cannot understand why he is hurt, or how he will be benefited. If the work is undertaken too late convalescence will be complicated by erections of the penis, which may tear out stitches and jeopardize the success of the operation. Delay may also engender a morbid state of mind from a consciousness of an abnormal sexual condition that will be difficult to overcome.

Before beginning any plastic operation on the penis it will be wise in most cases to establish perineal drainage of the bladder in order to prevent soiling the wound with urine. This may be done temporarily by an incision through the perineum and the insertion of a catheter into the bladder, with the occlusion of the urethra anterior to the opening by an encircling silk suture tied moderately tight over a small pad of gauze. It may be done more permanently by making an incision through the perineum and suturing the mucous membrane of the urethra to the skin, thus producing a fistula through which the urine will escape. If a urethrostomy is done the opening should not be closed until the series of operations for hypospadias is completed, although this may take several years.

The cure of hypospadias consists essentially of three steps: First, the correction of the deformity of the penis; second, the formation of a new urethra from the glans to the hypospadiac opening; and third, the connection of the two channels at the point where they meet. Of these the first is the easiest, but by far the most important. The correction of the congenital chordee,



FIG. 3.—Transverse incisions to correct congenital chordee. Redrawn from Young.

STUART McGUIRE

which always exists to a greater or less degree in these cases, is accomplished by making a transverse incision on the under side of the penis, dissecting out all constricting fibrous bands, and suturing the cut longitudinally. If one incision is not sufficient to straighten the penis, then a second similar one

should be made above or below it. If too much tension results it can be relieved by an opposite plastic, consisting of a longitudinal incision on the dorsum of the penis with transverse closure. If the first attempt to correct the deformity is not successful, then the operation should be repeated. Unless the penis is properly lengthened and straightened before the formation of the new urethra, the final result will not be satisfactory.

The difficulties in the formation of the new urethra will depend largely on whether the hypospadiac opening is glandular, penile or perineal. Other things being equal, the longer the channel the more difficult the task. Various plastic operations have been devised to form the urethra by Beck, Duplay, Mayo, Thompson, Russell and others. I will not attempt to describe them, but they are all



FIG. 4.—Transverse incisions sutured longitudinally to straighten and lengthen penis.—Re-drawn from Young.

attended by frequent partial failures which are most disappointing and disheartening. Surgeons who have had personal experience with these operations will read with sympathetic understanding the following review of his work by Hugh H. Young:

"The study of results show that in almost all instances one or more small breaks occur in the line of sutures and fistula may form. These may be due to tension, infection,

#### FORMATION OF URETHRA IN HYPOSPADIA

imperfect circulation and uncontrollable erections. Occasionally the glandular portion has completely broken down. In other cases the glands have remained intact and one or two small fistulae have formed, generally immediately back of the glans and at the point of closure over the old meatus. Subsequent operations were required and sometimes repeated two to three times before every fistula was healed. Occasionally pin-point openings, which caused little or no inconvenience, were extremely difficult to close and sometimes remained regardless of all efforts."

About three years ago I had an unusually hard day's work ahead of me. One of the patients to be operated on was a boy with hypospadias, whose penis I had straightened some six months previously. In making out the schedule of operations I put the case of hypospadias last on the list in order that I might be able to give it all the time it required. As I worked that day the satisfaction I felt as I finished each case at the progress I was making was marred by the recollection of the tedious and time-consuming operation for hypospadias that was yet to come.

One of the last cases was a woman with fibromyomata of the uterus. After I did the hysterectomy I looked at her appendix. It was unusually long, large and healthy. I was suddenly seized with an inspiration to use it in some way to make the new urethra for the boy. I removed the appendix and put it in a basin of normal saline solution.

When the patient with hypospadias was being anaesthetized, I cut off the tip of the appendix and washed out its interior by injecting saline through its lumen with a syringe. I then passed a No. 10 F. soft rubber catheter through it. I next placed it on a flat pad of moist gauze and got a nurse to steady it by holding each end of the catheter. With a sharp knife I made a longitudinal incision from one end to the other of the appendix opposite the mesenteric attachment, going through the serous and muscular coats but not through the submucosa and mucous lining. I caught the edges of the

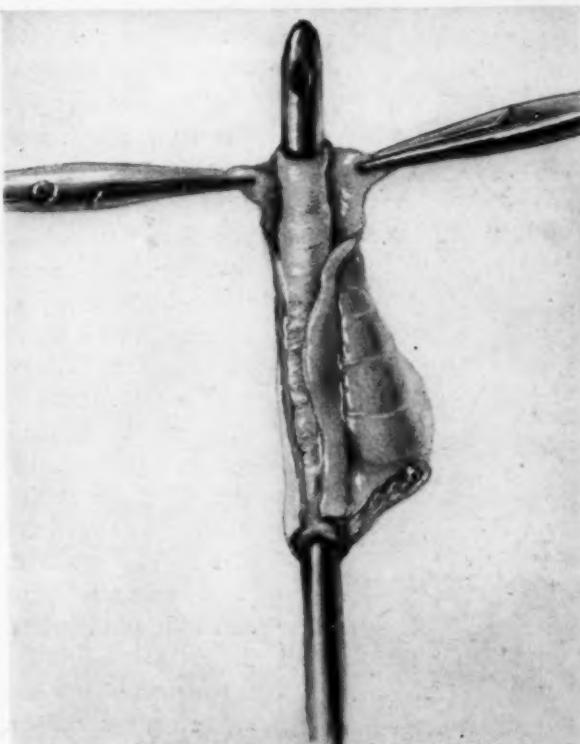


FIG. 5.—Appendix threaded on catheter. External coats being removed from sub-mucosa and mucous lining.

STUART McGUIRE

incision with forceps and by stripping with gauze I easily peeled the outer coats off and left a tube of mucous membrane threaded on the rubber catheter. I finally tied a circular ligature of silk around the distal end of the catheter and its covering of mucous membrane to prevent them slipping, cut one end of the ligature short and carried the other end by means of a curved needle through the eye of the catheter and out at the centre of its conical tip.

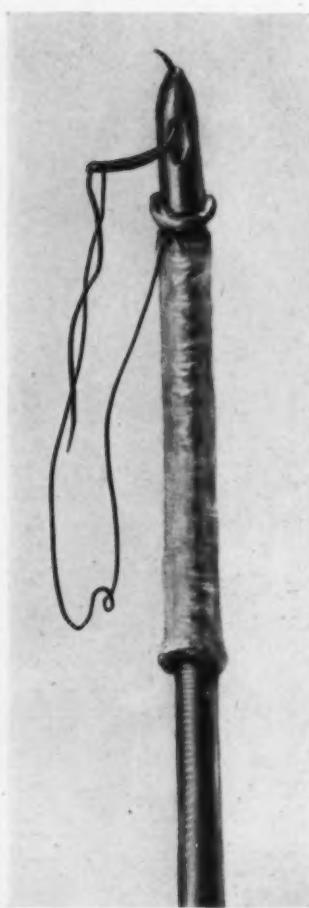


FIG. 6.—Mucous lining of appendix tied on catheter. Traction suture.

This was done with the purpose of using the suture as a tractor to draw the catheter and tubular graft of mucous membrane through the track I proposed to make in the penis of the patient.

The boy was placed in the dorsal position on the table and his penis flexed on his abdomen so that it lay on a pad of gauze with its ventral surface uppermost. A stab wound was made in the glans penis at the site of the normal urethra opening and a short transverse incision was made through the skin just anterior to the hypospadiac opening, which was at the junction of the penis and scrotum. The point of a large trochar armed with a canula was inserted into the stab wound in the glans and the instrument was forced along the penis beneath the skin until its point emerged at the incision at the hypospadiac opening. The trochar was withdrawn, leaving the canula in place. The butt end of a fenestrated probe was passed down the canula, and the suture threaded on it. It was hoped that by traction on the suture the catheter could be drawn through the canula, but it proved too large to go through its lumen. However, by drawing the tip of the catheter firmly into the opening of the canula, it readily followed the instrument as it was withdrawn.

The catheter with its covering of mucous membrane was now in the desired position. Its two ends were cut off so that they projected only

about one-half inch. The circular edges of the two ends of the graft were everted and sutured by several silk stitches to the mucous membrane of the glans above and to the skin at the base of the penis below. The parts were then dressed with sterile vaseline.

The section of rubber catheter was allowed to remain in place for one week. When it was removed there was some superficial necrosis at the two ends of the graft, but the wound was otherwise in good condition. Two or three days later dilatation of the channel was begun by passing a No. 12 silk ureteral catheter through it. There was no obstruction or tendency to

#### FORMATION OF URETHRA IN HYPOSPADIA

contraction. The boy soon learned to pass the instrument himself, and was shortly sent home. Six months later he returned to the hospital and the new urethra was found to be most satisfactory. The urinary fistula at the base of the penis was then closed by a plastic operation.

Since the case above reported I have had two others on whom I have operated, using the same method with equally good results.

I have now on hand a fourth case, whose condition will put a severe test to any surgical procedure employed for its relief. At the boy's birth the obstetrician pronounced him a girl, and as such he was christened and raised. When he was three years of age his mother became uncertain as to his sex, and took him to Doctor Russell, of Baltimore, for examination, who told her the child was a male, but advised postponing any operative intervention until he was older.

The mother carried the child home and was then confronted with the problem of changing his name. She was a woman of strong religious convictions and her conscientious scruples were only reconciled by a second baptism which caused considerable gossip among her neighbors.



FIG. 7.—Trocar withdrawn—Canula in tract of new urethra.

STUART McGUIRE

When the boy came to me about two months ago he was fourteen years of age and was masculine in development. Examination showed the urethral orifice in the perineum about an inch in front of the anus. The scrotum was cleft but the testicles could be palpated on either side. The general appearance was not unlike that of two large labia majora. The penis was curled downwards and backwards and hooded over with skin which bound it in

its abnormal position, so that it could readily have been mistaken for a large clitoris.

By a plastic operation I corrected the bifurcated scrotum and developed a rather formidable penis. I sent the patient home with instructions to return in six months if he wished me to attempt to create a new urethra. I sincerely trust he will be satisfied with the cosmetic result of what has been done for him. If he returns, as I fear will be the case, I will have to keep him waiting until I find a donor with an unusually long appendix, or else splice two together, as the distance from the tip of the glans penis to the hypospadiac opening in the perineum is at least six inches.



FIG. 8.—Mucous lining of appendix in position.

AUTHOR'S NOTE.—In the discussion of this paper, Dr. Hugh H. Trout, of Roanoke, Va., said he had learned of the work I was doing through one of my associates and he had employed the method with satisfactory results in one case. The patient was a negro boy fifteen years of age with hypospadias of the penile type. Doctor Trout removed his appendix and used the mucous lining to form the new urethra. He thought when it was impracticable to use the patient's own appendix it was desirable to match the donor with the patient as was the custom in blood transfusions.

Dr. Robert H. Morris of New York said he remembered that some years ago Dr. Charles M. Rosser of Dallas, Texas, had reported a case of a woman with traumatic injury of the neck of the bladder whose urethra he had restored by using the appendix.

Dr. V. P. Blair of St. Louis, Mo., said he was much surprised at the results secured in the cases reported, because in his experience no graft would grow that was transplanted from one individual to another. In his own work he had been very successful

## FORMATION OF URETHRA IN HYPOSPADIA

with autographs or the transplantation of the skin of a patient from one part of the body to another, but that he had always failed with heterographs or the transplantation of the skin of one patient to another.

In closing the discussion I said that I was familiar with Doctor Blair's views which were stated in his book on *Plastic Surgery*, and at the time I used the mucous membrane of the appendix of a woman to make the urethra for the boy I regarded the operation as an experiment and really did not expect it to succeed. I was not now certain that the mucous membrane had grown as a graft. It may have done so, but on the other hand the reticulated sub-mucosa may have simply acted as a scaffolding on which the individual cells proliferated, or finally owing to the persistency with which the tract was kept open by mechanical dilatation, after the operation it is possible the epithelial lining may have resulted from the growth of epithelial cells from the mucosa of the glands and the skin of the perineum. Be the explanation what it may, the practical fact is that by the use of the method described there are now three cases of hypospadias with open channels which permit the passage of urine.

Despite my respect for Doctor Blair's opinion, I wonder whether his statement that it is impossible to successfully transplant skin from one individual to another can be true. It is certainly contrary to the teachings of the older text-books and to the present practice of many experienced surgeons. I can now recall numerous cases in which I thought I had employed heterographs successfully.

Doctor Blair knows infinitely more about skin grafting than I do. With what he says about his practical and experimental work, it seems possible that I have been mistaken in the credit I gave skin grafting in my practice. It is possible the grafts only acted as a protective and stimulating dressing. I shall give the question further thought and study, but I must admit that at this time I believe heterographs will grow.

## SUTURE TECHNIC FOR ABDOMINAL CLOSURE IN CASES OF DRAINAGE\*

BY FRANCIS REDER, M.D.  
OF ST. LOUIS, MO.

THE principal object in effecting a good closure of an incisional wound of the abdominal wall, not infected, is to prevent the formation of a post-operative hernia.

With our present method of the étagen suture and the excellent absorbable suture material at our disposal, the apprehension of the surgeon relative to such an unfortunate happening, has been greatly lessened.

This is a happy retrospect when the unsatisfactory results of the "through-and-through" suture in the early days of antiseptic surgery are recalled.

It is quite true, however, that even with the enlightened progress in this particular phase of surgery, post-operative hernias in non-infected cases are still surprisingly large.

For the chief causes of post-operative hernia, apart from some constitutional disease, such as syphilis, which prevents rapid and sound healing, we must look to sepsis of the wound as the agent responsible for the greatest number of cases.

The prolonged use of drainage, a badly chosen incision, imperfect suturing, poor suture material, neglect in arresting bleeding with a resultant haematoma of the abdominal wall, and perhaps the premature subjection of the operative scar to strain, are other factors. Most of these cases reflect to a certain extent upon the operator, and are preventable.

To indifferent suturing, next to infection, must be attributed a large number of post-operative hernias for which no other explanation can be offered.

In a paramedian wound it is well to bear in mind that the aponeurotic structures, which are the chief barriers against protrusion of the abdominal viscera, show a great difference in their anatomical construction. For instance, in the upper abdomen the direction of the fibres in the posterior rectus sheath is at right angles with the line of incision. The fibres are almost all transverse in this sheath. Attempts at suturing will often be unsuccessful, unless there is sufficient relaxation of the patient to relieve the strain, otherwise the suture will cut out. With the anterior layer it is different. Here the construction of the sheath shows an interlacing of its fibres. When the edges of the aponeurosis have been sutured together, there is little likelihood that the suture line will not successfully resist great tension. This is a protection for the deep line of suture.

The suture technic of an abdominal wound in the presence of pus that

---

\* Read before the Southern Surgical Association, December 15, 1926.

ABDOMINAL CLOSURE IN CASES OF DRAINAGE

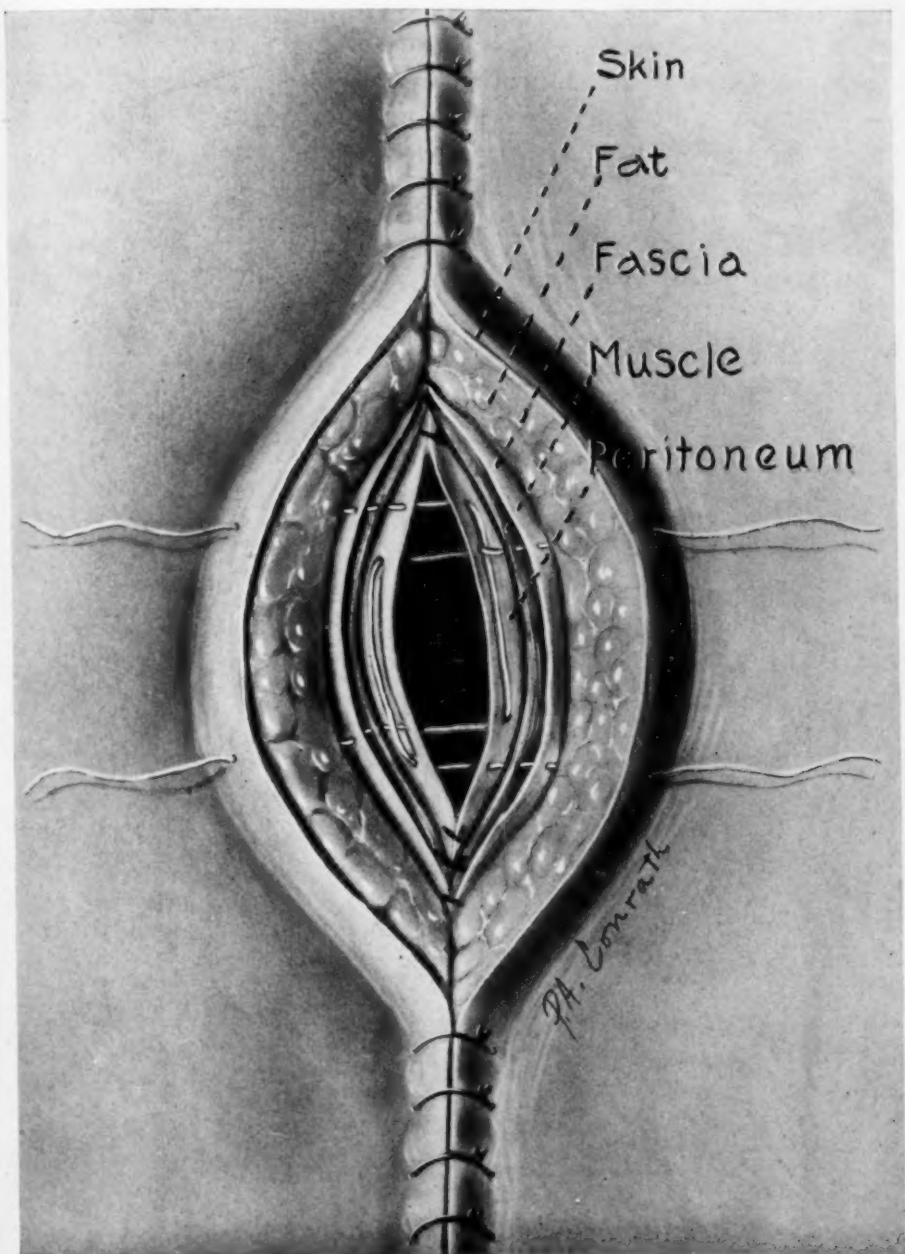


FIG. 1.—Twin mattress suture introduced through posterior rectus sheath and peritoneum. The suture material, for convenience of identification, is iron dyed (black) silkworm gut. The suture enters the skin about  $\frac{1}{4}$  inch from the wound margin. It passes through the anatomical structures and penetrates the posterior rectus sheath, including the peritoneum,  $\frac{1}{8}$  inch from its margin. The suture is then carried across the wound and engages the opposite structures, *i. e.*, peritoneum and posterior rectus sheath, piercing them from within out  $\frac{1}{8}$  inch from the margin. The suture then incorporates about  $\frac{1}{8}$  inch of the body of the posterior rectus sheath, and piercing it and the peritoneum from without in, is again carried across the wound to the opposite structures, *i. e.*, peritoneum and posterior sheath, which it penetrates from within out  $\frac{1}{8}$  inch from the margin. It is then made to pierce the anatomical structures in its path as it emerges on a line  $\frac{1}{8}$  inch below the point of entry. The opposing suture is placed in a similar manner. In introducing the opposing suture an interval of  $\frac{1}{8}$  inch should be allowed for tissue play.

FRANCIS REDER

was in evidence prior to the operation, differs but little from the technic applied to a non-infected wound.

In an infected wound the abdominal closure cannot be effected completely as there must remain an opening for drainage. The part of the wound not

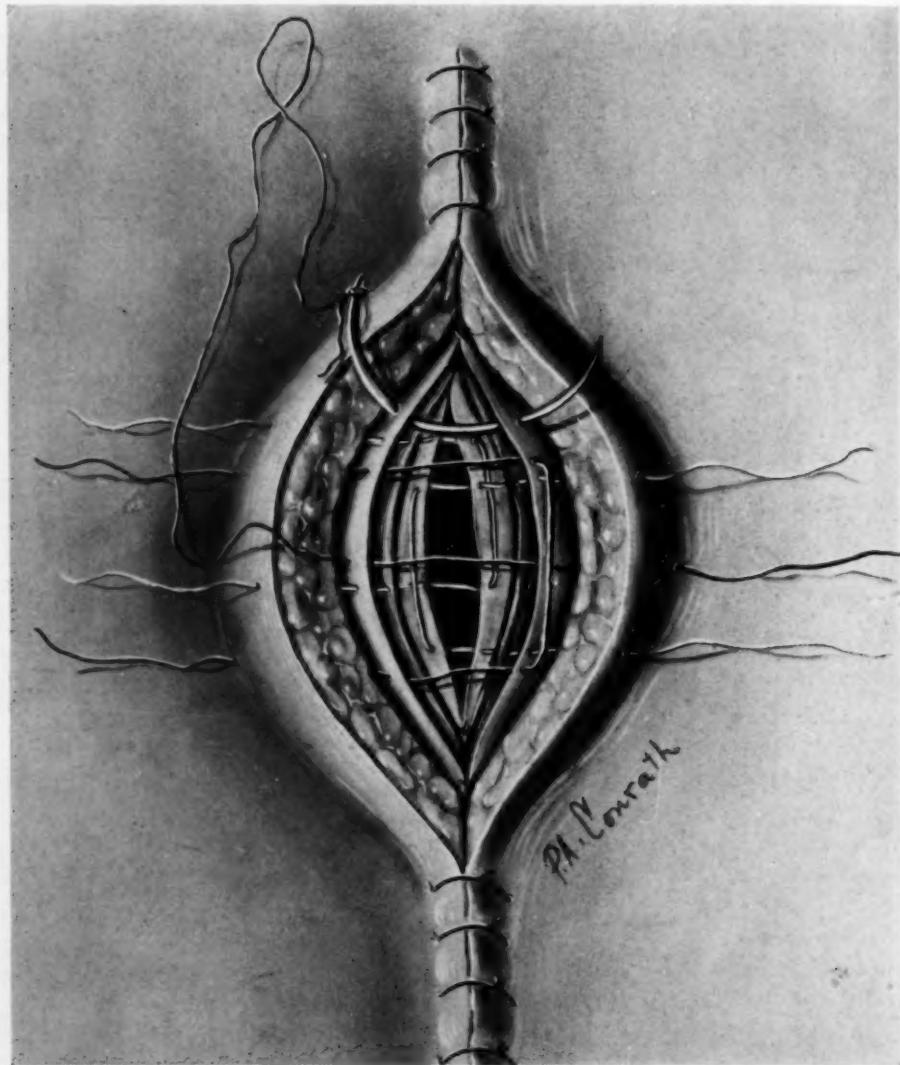


FIG. 2.—Twin mattress suture introduced through anterior rectus sheath. The suture material used is the undyed (white) silkworm gut for convenience of identification. The technic for the introduction of this suture is similar to that employed in placing the deeper suture. The only interposing structure which is penetrated is the fat between the skin and aponeurosis.

implicated in drainage should receive the same careful attention in the accurate apposition of its structures as a case free from sepsis, *i.e.*, the patient's condition permitting. This has been impressed upon me when in some of my infected cases the wound was smeared with pus and primary union of the abdominal wall resulted.

#### ABDOMINAL CLOSURE IN CASES OF DRAINAGE

The drainage opening, if certain precautions are taken, should cause but little concern as to the future functional results of the abdominal wall. By these precautions I mean the introduction of a certain type of suture at the time of operation into the aponeurotic structures bordering on the drainage

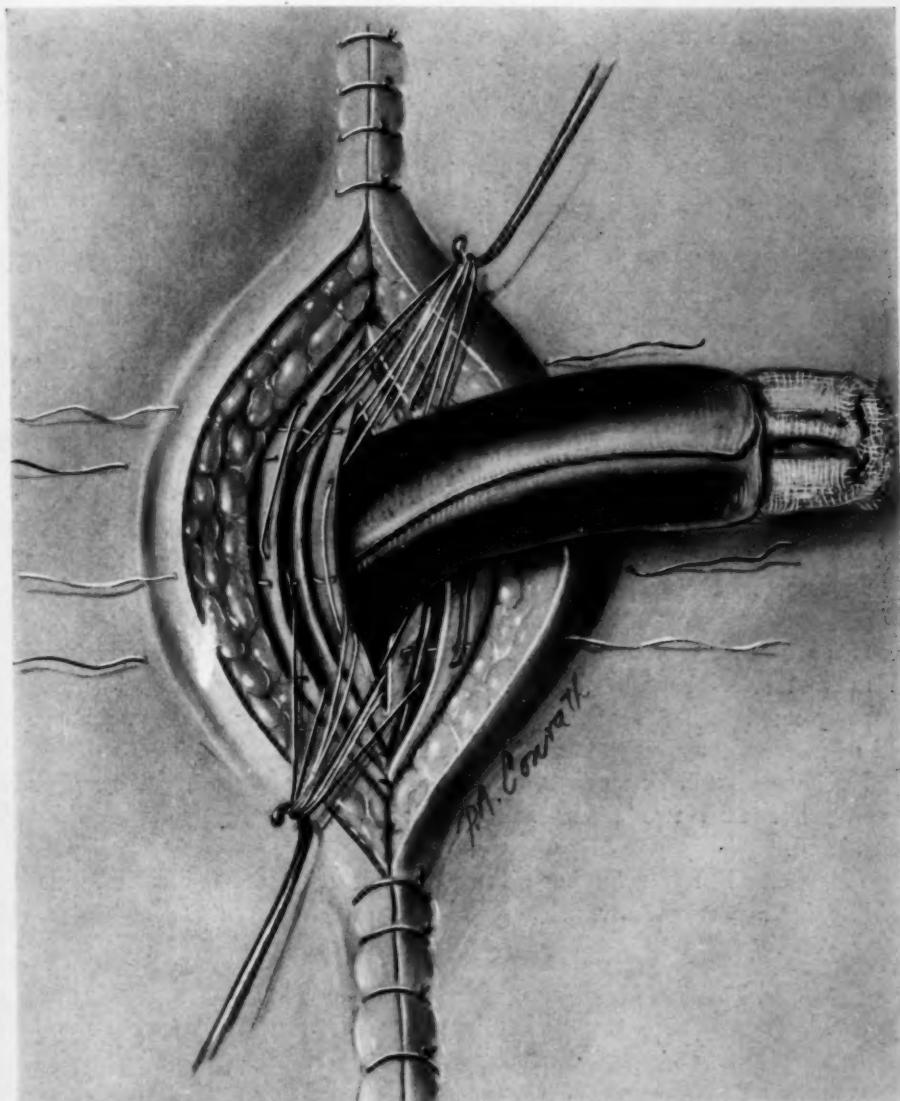


FIG. 3.—The twin mattress sutures are in place and the silkworm gut strands bridging the wound are held apart for the introduction of the drain. After the removal of the drain, traction in opposite direction upon the respective sutures will close the wound with good apposition of the corresponding structures. The sutures are secured individually and tied over a small roll of gauze.

opening. These sutures are placed in such a manner that after the removal of the drain, traction upon them in opposite directions will cause an accurate apposition of the divided structures. For want of a better term I have called this suture the "twin mattress suture."

FRANCIS REDER

The material used is silkworm gut. For the posterior rectus sheath iron dyed silkworm gut, on account of its black color, is used. For the anterior rectus sheath the undyed silkworm gut is employed. It is necessary to use suture material of a different color to simplify the identification of the fascial structures carrying the different sutures.

The suture is introduced through the skin about three-quarters inch from the wound margin. It passes through the anatomical structures and penetrates the posterior rectus sheath, including the peritoneum an eighth of an inch from its edge. The suture is then carried across the wound and engages the opposite posterior rectus sheath, piercing it and the peritoneum from within out and about an eighth of an inch from the aponeurotic margin. This suture incorporates about half an inch of the body of the posterior rectus sheath, and piercing it from without in it is again carried across the wound to the opposite posterior sheath, which it penetrates, including the periosteum, from within out about an eighth of an inch from its margin. It then pierces the anatomical structures in its path as it emerges on a line a half inch below the point of entry.

The opposing suture is placed in a similar manner. In introducing the opposing suture an interval of an eighth of an inch should be allowed for tissue play. The technic for placing the sutures in the anterior rectus sheath is similar to that of the posterior sheath. In this region the only structure interposing between skin and aponeurosis is fat.

In a wound three inches long, which can be considered a large drainage wound, three "twin mattress sutures" will answer the purpose. After the sutures are in place the strands stretching across the wound are pulled aside to facilitate the introduction of the drain. The ends of the sutures are properly cared for so that they can be readily assembled and tied over a small roll of gauze after the drain has been removed.

No haste should be made in removing the "twin mattress sutures," and nothing less than two weeks after the removal of the drain should be considered.

This method of suturing has given me excellent results in cases where the liability for a post-operative hernia was great.

## THE TREATMENT OF TETANUS

BY SAMUEL OSCAR FREEDLANDER, M.D.

OF CLEVELAND, OHIO

FROM THE UNIVERSITY SURGICAL CLINIC OF THE CLEVELAND CITY HOSPITAL

THE purpose of this report is to record a series of 25 consecutive cases of tetanus, treated uniformly and analyzed so as to offer a basis for some conclusions regarding the therapeutic value of tetanus antitoxin when used intravenously. If others will consistently use one method of treatment in a series of cases, and analyze them in a similar manner, eventually there will be some firm basis for the use of antitoxin. In many cases of this series, excessive amounts were used. This was done in order to satisfy ourselves as to its therapeutic limits when used intravenously.

It is generally agreed that antitoxin is the only measure which has thus far offered any hope of success in the treatment of tetanus. However, its real value is still in doubt, largely because tetanus statistics are so unreliable. Very few series of tetanus cases have been reported, throughout which, there has been any consistency in the size of dosage or mode of administration of antitoxin.

The gross mortality rate of tetanus in pre-serum days, that is before 1896, was 75 to 85 per cent. This is deduced from sources such as the Civil War,<sup>1</sup> the Franco-Prussian War,<sup>1</sup> Guy's Hospital,<sup>1</sup> Massachusetts' General Hospital,<sup>2</sup> etc. In isolated instances there were collections from various sources with much lower mortality rates, such as Curschmann's series,<sup>1</sup> in 1889 of 912 cases with a rate of 44.1 per cent., and Curling's<sup>1</sup> of 128 cases at the rate of 54.5 per cent.

The inverse relation of the incubation period to the mortality rate has long been known, the longer the incubation period the less the death rate. Jacobson,<sup>3</sup> in 1906, analyzed a large number of these earlier reports and showed that for cases with an incubation period under ten days the rate was 83 per cent. and only 43.6 per cent. if the incubation period were ten days or more. Thus the gross mortality rate unless analyzed for at least the incubation period is of little value for comparative purposes.

Since the use of antitoxin has become widespread, and especially in recent times when large doses have been used, the reports of tetanus cases show a lowered mortality rate.

In 1923, Miller,<sup>4</sup> reported from Massachusetts' General Hospital:

Since 1896—96 cases mortality rate 67.7 per cent.

Since 1910—45 cases mortality rate 57.8 per cent.

Since 1916—25 cases mortality rate 52 per cent.

In 1918, Cooper,<sup>4</sup> reported 102 cases with a rate of 55 per cent.

In 1921, Stone,<sup>5</sup> 49 cases with a rate of 53 per cent.

In 1922, Ashhurst,<sup>6</sup> 18 cases with a rate of 33 per cent., and many others with rates around 50 per cent.

## SAMUEL OSCAR FREEDLANDER

Figures from the last war are of little value because practically all of the cases had had one or more prophylactic injections of antitoxin. When prophylaxis does not prevent tetanus it has the effect of prolonging the incubation period and also increasing the incidence of local tetanus, both of which reduce the gross mortality rate. Bruce<sup>7</sup> showed that in 1429 cases which developed the disease after having had prophylactic injections, the average incubation period was thirty-nine days and the mortality rate 21 per cent., while in the non-protected cases, the incubation period was eleven days and the mortality rate 57 per cent. The treatment was about the same.

None of these statistics allow us to draw accurate conclusions as to the value of antitoxin because (1) there is a tendency to report only the successful series; (2) there is no uniformity in any one series as to the doses of antitoxin, the mode of injection or the adjuvant use of other measures; (3) many of the groups make no mention of the incubation period.

The series reported in this paper consists of 25 cases, which were treated at the Cleveland City Hospital between 1918-1926. The treatment was uniform in that large doses of antitoxin were injected intravenously at frequent intervals. The following régime was used:

(1) The local treatment of the wound consisted of making all parts accessible to the air by the removal of devitalized tissue. In many cases the wound was of little consequence. A small amount of antitoxin was usually injected around the wound.

(2) Within the first twenty-four hours a total of 50,000 to 150,000 units of antitoxin was given intravenously, divided into three to five injections. Thereafter a daily dose of 15,000 to 150,000 units intravenously in from two to three injections. This was continued well into convalescence, sometimes as long as twelve to fifteen days, depending upon the muscular rigidity. In the later cases injections were not continued as long.

(3) Morphine was given hypodermically every six hours, and chloretone every six hours by rectum.

(4) Food and fluids were urged.

The rationale of this treatment is as follows:

From confirmed experimental data,<sup>8, 9</sup> it is known that tetanus toxin appears early in the blood stream, and it is from here that it is taken up by the motor nerve endings. It has been shown that tetanus antitoxin can only neutralize the toxin which is in the blood stream. Toxin already bound by the central nervous system cannot be influenced. Furthermore, antitoxin is excreted very rapidly. The aim of treatment should be to maintain a high concentration of antitoxin in the blood in order to neutralize whatever toxin is already there and also that which is being given off from the focus of infection. Thus the toxin would be neutralized before being taken up by the nerve endings. The most practical way to maintain a high concentration in the blood stream is by repeated intravenous injections. Intraspinous injections, theoretically, offer the slight advantage of neutralizing more directly the small amount of toxin in the spinal fluid, which would also be neutralized

## THE TREATMENT OF TETANUS

TABLE I.

Name	Age	Location of wound	Incub. period	Delay treat.	Antitoxin injected 1st 24 hours	No. of inj. 1st 24 hrs.	Total amt.	Hosp. days	Result	Reaction
W. R. . . . .	11	Hand	7 days	1 day	144,000	5	384,000	23	Recovered	None
W. K. . . . .	6	Foot	18 days	3 days	90,000	3	270,000	18	Recovered	None
J. N. . . . .	10	Foot	10 days	1 day	60,000	3	178,000	28	Recovered	None
B. A. . . . .	18	Thigh	8 days	1 day	160,000	5	590,000	54	Recovered	None
F. H. . . . .	34	Foot	8 days	1 day	65,000	3	27	Recovered	None	
M. B. . . . .	39	Hand	?	15 hrs.	55,000	2	55,000	11 hrs.	Died	None
A. B. . . . .	8	Foot	11 days	3 days	45,000	3	194,000	38	Recovered	None
M. R. . . . .	11	Hand	5 days	1 day	90,000	3	190,000	2	Died	None
R. M. . . . .	9	Arm	21 days	2 days	{ 80,000 spin. 40,000 musl.	2	757,000	23	Recovered	Chill, urticaria
A. M. . . . .	7	Foot	6 days	1 day	60,000	2	60,000	12 hrs.	Died	None
J. S. . . . .	34	Toe	9 days	3 days	70,000	3	695,000	18	Recovered	None
P. N. . . . .	33	Foot	60 ?	1 day	50,000	1	50,000	13 hrs.	Died	None
T. M. . . . .	49	Foot	7 days	1 day	68,000	2	68,000	6 hrs.	Died	None
J. S. . . . .	7	?	?	3 days	48,000	2	296,000	18	Recovered	None
E. G. . . . .	4	Foot	10 days	3 days	{ 40,000 15,000 musl.	2	330,000	24	Recovered	None
F. Z. . . . .	33	?	?	1 day	105,000	4	545,000	30	Recovered	Chill, urticaria
C. N. . . . .	36	?	?	4 days	60,000	2	90,000	36 hrs.	Died	None
J. W. . . . .	18	Head	6 days	1 day	80,000	3	80,000	18 hrs.	Died	None
E. C. . . . .	8	Foot	14 days	6 days	60,000	2	789,000	49	Recovered	Chill, urticaria
G. B. . . . .	43	Finger	7 days	10 days	63,000	3	233,000	27	Recovered	None
W. A. . . . .	8	?	?	2 days	110,000	5	345,000	29	Recovered	None
W. S. . . . .	5	Foot	4 days	1 day	50,000	3	610,000	3	Recovered	None
J. S. . . . .	11	Foot	12 days	2 days	195,000	5	575,000	33	Recovered	None
L. H. . . . .	8	Foot	7 days	1 day	100,000	4	100,000	15 hrs.	Died	None
E. M. . . . .	13	?	?	4 days	100,000	4	170,000	48 hrs.	Died	None

SAMUEL OSCAR FREEDLANDER

from the blood stream, while practically, there is the difficulty of doing repeated spinal punctures on spastic tetanus patients. Antitoxin is not taken into the central nervous system from the spinal fluid.<sup>9</sup> Recently Wainwright<sup>10</sup> has emphasized the value of the intravenous use of antitoxin in large doses.

From the chart it will be seen that the gross mortality rate was 36 per cent. There were 11 cases with an incubation period of less than ten days, of which 45.5 per cent. died. Eight cases with an incubation period of ten days or over had a mortality rate of 12.5 per cent., and of six cases with an incubation period unknown, 50 per cent. died. Six of the nine deaths occurred within the first twenty-four hours after entrance into the hospital, and the other three within forty-eight hours. If the deaths within the first twenty-four hours are excluded, that is cases in which there was not time to administer sufficient toxin, the mortality rate would be 12 per cent.

It will be noted that in spite of the large doses, only three patients showed any sharp reaction, such as chill and urticaria. The same patients who reacted with a chill, developed urticaria several days later.

The amount of antitoxin given within the first twenty-four hours to the cases surviving that period, averaged 85,000 units. This was given in an average of three doses intravenously.

No doubt in many cases the antitoxin was continued longer than necessary, thus making the total doses too high. It was our impression at first

TABLE II.  
*Summary (City Hospital 1918-26.)*

	No.	Cured	Died	Mortality Per cent.
Incubation less than 10 days.....	11	6	5	45.5
Incubation 10 days or more.....	8	7	1	12.5
Incubation—unknown .....	6	3	3	50
Total .....	25	16	9	36

that if the injections were discontinued earlier the muscular rigidity and increased reflex-excitability persisted longer. This impression has not been confirmed with increased experience. It is doubtful whether it is necessary to continue the antitoxin longer than six or seven days.

The routine which we follow now is:

- 1st 24 hours 100,000 units 4-5 doses
- 2nd 24 hours 80,000 units 3-4 doses
- 3rd 24 hours 60,000 units 3 doses
- 4th 24 hours 40,000 units 2 doses
- 5th 24 hours 20,000 units 2 doses
- 6th 24 hours 10,000 units 2 doses
- 7th 24 hours 5,000 units 1 dose

This gives a total of 315,000 units for the average case.

## THE TREATMENT OF TETANUS

### SUMMARY

Twenty-five consecutive cases of tetanus were treated with large frequently repeated intravenous injections of antitoxin, with a mortality rate of 36 per cent. Eleven of these had an incubation period of less than ten days with a mortality rate of 45.5 per cent. If the six cases which died before sufficient antitoxin could be administered are excluded, the mortality rate would be 12 per cent.

The relatively low mortality rate in this series adds to the impression that tetanus antitoxin given in large doses intravenously has some therapeutic value.

It is hoped that others will record a series of cases, giving antitoxin consistently by some other route, so that the results may be compared.

### REFERENCES

- <sup>1</sup> Golla, F.: Lancet, vol. ii, p. 966, December 29, 1917.
- <sup>2</sup> Miller, R. H.: Surg., Gyn. and Ob., vol. xxxvi, p. 90, January, 1923.
- <sup>3</sup> Jacobsen: Quoted from Keen's Surgery, vol. i, p. 493.
- <sup>4</sup> Cooper: Lancet, vol. ii, p. 930, December 29, 1917.
- <sup>5</sup> Stone, W. J.: J. A. M. A., vol. lxxviii, p. 1939, June 24, 1922.
- <sup>6</sup> Ashhurst, A. P.: Arch. Surg., vol. i, p. 407, November, 1920.
- <sup>7</sup> Bruce, D.: J. Hygiene, vol. xix, p. 1, July, 1920.
- <sup>8</sup> Meyer, H., and Ransom, F.: Arch. f. exper. Path. v. Pha., vol. xxxix, p. 369, 1903.
- <sup>9</sup> Teale and Embleton: Jour. Path. and Bact., vol. i, p. 23, 1919.
- <sup>10</sup> Wainwright, J. M.: Arch. Surg.; vol. xii, p. 1062, 1926.

CHRONIC TETANY  
BY HENRY J. JOHN, M.D.  
OF CLEVELAND, OHIO  
FROM THE CLEVELAND CLINIC

IN THIS paper I am applying the general term chronic tetany only to that form of tetany which occasionally develops after a thyroidectomy, and which is caused, presumably, by either a direct or an indirect injury to the parathyroids. Acute tetany sometimes develops shortly after a thyroidectomy, but clears up after a few days of treatment and does not reappear. Such cases are due, doubtless, to some temporary derangement of the parathyroid glands which is quickly overcome. When, however, such a derangement does not promptly right itself and attacks of tetany reappear periodically, the condition may properly be designated chronic tetany. Whether tetany is due to the actual removal of the parathyroid glands, or to some injury inflicted upon them during an operation, or whether it develops later as the result, perhaps, of a contraction of the connective tissue which interferes with the vitality of the gland, is immaterial, as far as the present discussion is concerned.

According to statistical data chronic tetany of the type we are considering is of rare occurrence; but when it does occur, it is a serious condition, and it is fortunate alike for the surgeon and for the sufferers from this complication of thyroidectomy, that thanks to Collip and his co-workers a means of combating tetany of this type has been discovered.

Among the factors which make the treatment of chronic tetany a complex problem is the very considerable psychic disturbance with which it is associated. It is very difficult to evaluate this psychic factor, to say nothing of eliminating it. Some patients with apparent tetany are purely neurotic and the "tetany" can be eliminated if they remain under observation for a long enough period and are properly controlled.

One of my patients, a neurotic bookkeeper, who was supposed to have chronic tetany, had been making the rounds of the local profession for several years before she was turned over to me for treatment. Considering at first that I was dealing with a bona fide case of tetany, I started the administration of Collip's parathormone, giving one cubic centimetre intravenously twice a week and checking the blood calcium content at the same time. However, when the blood calcium was between 11 and 13 mg. per 100 c.c. of blood, my suspicion was aroused as to the true nature of the case, and I resorted to a subterfuge by substituting sterile saline solution for the parathormone. The relief of symptoms which followed the former was the same as that which followed the administration of the latter, while the blood calcium level remained unchanged. This patient is still going from one doctor to another, no doubt, and still receiving parathormone with apparently ideal results. Since the psychic factor in all cases of tetany must be considered, such a case

## CHRONIC TETANY

as the one we have cited emphasizes the importance of a proper control of all cases. In the following discussion of cases of tetany I shall, therefore, emphasize the psychic phenomena which may be met and the difficulties which are encountered in their treatment.

It is not strange that the psychic phenomena form an important part of the clinical picture in cases of chronic tetany, for these patients have experienced severe attacks of tetany and therefore they dread their recurrence, nor is it surprising that at the slightest suggestion of a recurrence of the symptoms of tetany these patients rush to the doctor's office in the hope that he may be able to thwart the attack. It is the uncertainty of the outcome which breaks their spirit—the fear that they will never be free from these attacks. Not knowing when an attack may occur, they keep away from social gatherings, they are afraid to ride alone on a street car. Some have a chronic diarrhoea. Nevertheless, in most of these cases the classical attacks of tetany marked by carpopedal spasm, Chvostek sign, etc., are rather far apart. When the attacks do occur, they cannot be attributed to any special cause, but they apparently come out of a clear sky and in a few minutes develop to their full severity. Moreover—and the following fact complicates the picture—in these attacks the serum calcium content is not exceedingly low, as is the case in acute tetany. (See Protocols I and II.) There are alternating variations in the serum calcium data with which the symptoms do not correspond. Thus in some cases a patient may feel best when the serum calcium is low and may have an attack of tetany when the serum calcium is not far from the normal level.

Protocol I gives the data in a case of chronic tetany which began with acute tetany six days after a thyroidectomy; the serum calcium ranging from 7 to 13 mg. per 100 c.c. In this case the symptoms were relieved by repeated injections of parathormone. At certain periods this patient remained free from symptoms for a month without taking any parathormone, so that at one time I began to think that a cure was being established. I began to suspect that there might be a psychic element in this case when in August, 1925, the symptoms diminished progressively, although during this month the patient received but two doses of parathormone when her serum calcium was 9.5 and 10 mg. per 100 c.c., respectively. On September 3rd, 10th and 24th I administered normal saline intravenously without the knowledge of the patient. My suspicion of a psychic factor seemed confirmed when following these injections the symptoms always subsided. For a month and a half the patient continued to receive saline solution instead of parathormone without having a single attack of tetany and I began to think that the problem of this case was solved and that I would soon be able to tell the patient what I had done and to assure her that her attacks were due to fear and that by subduing the fear she would be permanently cured. She remained symptom-free for four and one-half months, at the end of which time she had a slight attack, and on March 5, 1926, she came to the Clinic with the most severe attack of tetany I have ever seen, although even then her serum calcium was 9 mg. per 100 c.c.

## HENRY J. JOHN

## PROTOCOL I.

## CHRONIC TETANY

(Case No. 132,065. Woman, thirty-nine years of age. Tetany first developed October 28, 1924, six days after thyroidectomy.)

Date	Parathor-mone units	Serum calcium mg. per 100 c.c.							Notes
		7	8	9	10	11	12	13	
1925 Mar. 20	5					11			
Apr. 3	5						12		
6	5								13
7	7.5						12		
9	10					11			
10	10				10]				
14	7.5			9					
16	5	8.6							
21	10	8.1							
23	10	8.5							
25	10		9						
29	10		9.5						
May 1	10	8.6							
4	10		9						
6	10			10.5					
8	5				11				
11	10			10					
15	9.5			10					
19	5			10					
27	7.5				11.5				
29	5					12			
June 2	9				11.2				
5	6.5		9.5						
8	10				11.5				
11	7				11				
16	10			10					Not well.
		(Went on a trip to California, took 10-20 units per week.)							
July 28	10								Menstruating.
Aug. 3	10				10				Not well.

## CHRONIC TETANY

### PROTOCOL I.—Continued

#### CHRONIC TETANY

*(Case No. 132,065. Woman, thirty-nine years of age. Tetany first developed October 28, 1924, six days after thyroidectomy.)*

Date	Parathor-mone units	Serum calcium mg. per 100 c.c.							Notes
		7	8	9	10	11	12	13	
Aug. 29	10			9.5					Menstruating.
Sept. 3.	Saline					11			Not well. Perfect relief after injection.
10	Saline			9.7					Feels uncomfortable.
24	Saline			9.5					Slight drawing of muscles around mouth.
1926 Feb. 16	10		8.5						Slight attack.
20					10.5				
Mar. 2	20		8						
5	40			9					Very severe attack of tetany, lasting an hour.
6	20	7							Better.
8	20		8.5						Better.
9	40			9					Attack of tetany, less severe than above.
10	20		8						Not well.
11	20		8						Better.
13	40				10				
18	20		-	9					Slight tightness of abdominal muscles.
20	20			9.5					Well.
22	12				10				Well.
25	20		8.5						
29	16				10				Menstruating.
Apr. 5	20			9					Not well.
14	20			9					Slight tingling of muscles.
22	20				10.5				Slight dizziness.
May 5	20					12			Malaise.
(Took 10 units parathormone at home when she thought an attack was approaching.)									
June 5	40						12		Acute attack of tetany.
14	20					10			Slight tingling.

## HENRY J. JOHN

## PROTOCOL II.

## CHRONIC TETANY

(Case No. 124,350. Woman thirty-four years of age. Tetany first developed June 14, 1923, two days after thyroidectomy.)

Date	Parathormone units	Serum calcium mg. per 100 c.c.							Notes
		5	6	7	8	9	10	11	
1925 May 25						9			Feels wretched. Muscle spasm.
27	5					9			
June 1	10				8				Much better.
4	10					9.4			Much better.
6	6						10		Much better.
9	6							11	Much better.
12	5			7					Much better.
16	4			7					Much better.
20	10					9			Much better.
24	10				8				Much better.
27	10				8				Much better.
30	6				8				Much better.
July 3	10			7					Much better.
7	10				8				Better on the day of injection. (Had many severe attacks of tetany)
1926 Jan. 14	15		6						Severe attack night before.
16	20			7					Only slight relief.
18	15		6.5						Nervous.
Feb. 13	20				8				Several acute attacks.
17	20		6.5						Attack day before.
18	20				8				Feels fine. In hospital two days.
19	20		6.5						Feels fine. In hospital.
20	10				8				Feels fine. In hospital.
24	10			7					Feels fine. In hospital.

## CHRONIC TETANY

## PROTOCOL II.—Continued

## CHRONIC TETANY

(Case No. 124,350. Woman thirty-four years of age. Tetany first developed June 14, 1923, two days after thyroidectomy.)

Date	Parathor-mone units	Serum calcium mg. per 100 c.c.							Notes
		5	6	7	8	9	10	11	
1926 Feb. 27	20			7.5					Very weak.
Mar. 1	40	5.5							
2	40			8					
5	40			8					
6	20			7.5					Feels fine.
8	40			7.5					Feels fine.
9	10				8				Feels fine.
10	20				8.5				Feels fine.
11	40					9			Feels fine.
12	40				8				Feels fine.
13	40								Feels fine.
15	20			7.5					Feels fine.
16	40		6						Cramps.
17	40			7.5					Better.
18	40			7					
19	36			7					
20	40				8				
22	40				8				
23	40			7.5					
24	40			7.5					Better.
25	40				8				
26	40								Tired. Ultraviolet rays.
27	40		6.5						Ultraviolet rays.
30	40				8.5				
31	40			7.5					

## HENRY J. JOHN

## PROTOCOL II.—Continued

## CHRONIC TETANY

(Case No. 124,350. Woman thirty-four years of age. Tetany first developed June 14, 1923, two days after thyroidectomy.)

Date	Parathor-mone units	Serum calcium mg. per 100 c.c.							Notes
		5	6	7	8	9	10	11	
1926 Apr. 1	40				8				
2	40				8.7		10		
3	40								
5	40						10		
6	40				8.5				
7	40					9			
8	40					9			
9	40					9			
10	40			7.5					
12	40						10		
13	40				8.5				
14	40				8.5				Tired.
15	40								
16	40					9			
17	40					9.5			
19	40					9.5			
20	40		6						
21	40				8.5				
22	40				8.5				
23	40				8.5				
24	40					9			
26	40								
27	30					9			
28	40				8.5				Feels fine.
29	40				8.5				
30	40				8.5				"No pep."
May 3	40				8.5				
4	Saline				8.5				Feels fine.

## CHRONIC TETANY

### PROTOCOL II.—Continued

#### CHRONIC TETANY

(Case No. 124,350. Woman thirty-four years of age. Tetany first developed June 14, 1923, two days after thyroidectomy.)

Date	Parathor-mone units	Serum calcium mg. per 100 c.c.							Notes
		5	6	7	8	9	10	11	
1926 May 5	Saline				8				Not well.
6	40				8				
7	Saline			7					
8	Saline				8.5				Feels fine.
10	Saline						10		Tingling of fingers. Not well.
11	Saline			7.5	*				Tingling of fingers. Not well.
12	Saline				8				Saline relieves tingling. Well.
13	Saline					9			Feels fine.
14	Saline					9			Feels fine.
15	Saline				8.5				Feels fine.
17	Saline				8.5				Feels fine.
18	Saline				8.5				Feels fine.
19	Saline				8.5				Feels fine.
20	Saline				8.5				Feels fine.
21	Saline				8.5				Feels fine.
22	Saline				8.5				Very well.
24	Saline				8.5				Not well.
26	Saline				8.5				Well.
29	Saline				8				Well.
June 1	Saline				8.5				Well.
3	Saline				8.5				Well.
5	Saline			7.5					Well.
7	Saline				8				Feels fine.
8	Saline				8.5				Feels fine.
12	Saline				8				Feels fine.
14	Saline				8				Slight twitching of muscles of right eye.

## HENRY J. JOHN

Forty units of parathormone were administered intravenously, but it was a full hour before she was able to relax. After this occurrence, in spite of the serum calcium content, there was no doubt in my mind that we were dealing with a case of true tetany. Since that time the patient has been receiving parathormone at irregular intervals and is now taking it at home. When on June 5, 1926, she had her last attack of tetany, which was a severe one, her serum calcium was 12 mg. per 100 c.c.

The data concerning another case of chronic tetany are given in Protocol II. This patient, an Italian woman thirty-four years of age, developed acute tetany two days after a thyroidectomy. Her serum calcium fluctuated from 5.5 to 11 mg. per 100 c.c. She had been under steady treatment with parathormone for one and one-half months in 1925 (May to June), when her improvement became so marked that I asked her not to come for treatment unless her symptoms reappeared. She apparently did not understand me, for I did not see her again for six months and thought that she was remaining free from attacks. On January 14, 1926, however, she returned so weak and exhausted that she had to be carried into the Clinic. She reported that she had had many attacks during the preceding six months and was taking calcium lactate by mouth. Marked improvement followed when the parathormone medication was resumed and the patient insisted on coming in daily. Her average serum calcium was about 8 mg. per 100 c.c. with few variations in either direction. On May 9, 1926, I resorted to the use of normal saline instead of parathormone and have continued to use this up to the present writing (August, 1926). The patient has felt well, has had no attacks of tetany and there has been no appreciable change in the serum calcium level. Whether or not tetany will again develop as in the preceding case cannot, of course, be predicted.

It would appear that although, as these cases indicate, a psychic factor is present in certain cases of chronic tetany, nevertheless since it is impossible to know whether or not a true attack may develop, it is necessary to administer parathormone extract to these patients more or less continuously. The administration of parathormone extract is followed by relief in all cases. False attacks due to the psychic factor, however, are equally well relieved by the injection of saline solution.

In the literature the chief stress has been placed upon the rôle of the parathyroid glands in the metabolism of calcium. Nevertheless, I cannot but feel that faulty calcium metabolism represents only a part of the actual problem with which we are dealing in these cases of chronic tetany. I have repeatedly seen patients with chronic tetany who felt quite well when the serum calcium was 7 or 8 mg. per 100 c.c. while these same patients have complained of much discomfort when the serum calcium was 11 or 11.5 mg. per 100 c.c. Thus the patient whose history is cited above felt well when her serum calcium was 7 or 8 mg. per 100 c.c., while the most severe attack developed when the blood calcium was 9 mg. per 100 c.c. It is hard, therefore, to believe that the serum calcium can be a direct index to the severity of the

## CHRONIC TETANY

condition. I believe, rather, that the calcium content of the blood represents but a part of the complex picture presented by this disease.

In an attempt to secure some light on this complex problem, I have made a study of the literature and have reviewed my own series of cases of parathyroprival tetany. A brief résumé of the findings in these studies will be given here.

All authors agree that in parathyroprival tetany a low calcium content of the blood is found. Attempts to remedy this condition by the oral supply of calcium, however, have never been successful, showing that the primary cause of tetany is not a reduction in the amount of calcium in the circulation, but rather a disturbance of the mechanism for its proper utilization. Thus, Denis and Corley<sup>1</sup> found that the tissues of rabbits which had received a daily dose of calcium chloride or calcium lactate failed to show a higher calcium content than did the tissues of the control animals. These investigators found also that daily exposure to ultra-violet rays from a mercury tungsten arc had no effect on the calcium content of the tissues or serum.

SWINGLE and RHINHOLD<sup>2</sup> exposed animals with tetany to ultra-violet radiation with the same results, that is, they found no change in the calcium content of the blood serum. They did find, however, that radiation greatly prolonged the life of the parathyroidectomized animals and brought about a striking amelioration of the violent symptoms.

According to SWINGLE and WENNER<sup>3</sup> the withdrawal of a considerable quantity of blood from dogs suffering from parathyroprival tetany temporarily relieved the symptoms and induced a marked rise in the level of the serum calcium, the symptoms disappearing as the serum calcium rose. This beneficial effect lasted from ten to twelve hours, after which the tetany returned.

GREENWALD<sup>4</sup> administered calcium salts to thyroparathyroidectomized dogs and found first that a large part of the calcium was deposited in the tissues, chiefly as calcium phosphate; while later a calcium equilibrium was established. In a parathyroidectomized dog which had received a liberal supply of calcium, there was a normal concentration of calcium in the serum and the animal was as resistant to the administration of sodium phosphate (50 mg. of phosphorus per kilogram of body weight) as were normal dogs. Later, when the supply of calcium was diminished, the concentration of the calcium in the serum was also diminished and the injection of the same amount of sodium phosphate was followed by tetany.

WEST<sup>5</sup> gives the following figures for the forms in which calcium occurs in normal individuals:

Total calcium .....	12.4 mg. per 100 c.c. of blood serum
Ionizable calcium .....	9.0 mg. per 100 c.c. of blood serum
Colloidal calcium .....	3.4 mg. per 100 c.c. of blood serum

For the maintenance of the calcium equilibrium in a healthy man accustomed to ordinary diet, 0.7 gram calcium oxid per day seems to be the minimum requirement. However, during the period of bone formation and growth the need of an abundance of calcium is obvious.

The weakening of the bones and teeth which is said to be a common accompaniment of pregnancy and of lactation is largely due to a preventable withdrawal of lime from these structures.

When other forms of food are substituted for mother's milk, the calcium intake is more likely to be deficient than any other inorganic element. To cover the need of calcium, foods which are high in calcium content should be chosen.

## HENRY J. JOHN

In a personal communication to the author an obstetrician made the following statement: "I give always plenty of milk daily to a pregnant woman, and I find that by this I can more than save on dentist bills the cost of the milk."

Table I shows how greatly the calcium content of different foodstuffs varies. Milk contains so much calcium that only enough to yield 400 calories is required to supply one gram of lime, while the calcium content of round steak and white bread is so low that enough to yield 10,000 calories would be required to supply the same amount of lime.

ANDERSON<sup>\*</sup> found an average of 10.7 mg. of calcium per 100 c.c. of blood serum in patients under forty-five years of age and 10.4 mg. per 100 c.c. in persons above this age. His work included a study of 38 patients with normal blood findings. The actual range

TABLE I.  
*Calcium Content in Different Foodstuffs. (After Sherman)*

Foodstuffs in order of calcium content	Calcium oxide per 100 gms. of edible substance	Foodstuffs in order of calcium content	Calcium oxide per 100 gms. of edible substance
Almonds . . . . .	0.30	Oranges . . . . .	0.06
Beans, dried . . . . .	0.22	Prunes, dried . . . . .	0.06
Egg yolk . . . . .	0.20	Wheat, entire grain . . . . .	0.06
Milk . . . . .	0.17	Low grade flour . . . . .	0.04
Peas, dried . . . . .	0.14	Beets . . . . .	0.03
Oatmeal . . . . .	0.13	Potatoes . . . . .	0.02
Walnuts . . . . .	0.11	Pineapple . . . . .	0.02
Peanuts . . . . .	0.10	Bananas . . . . .	0.01
Parsnips . . . . .	0.09	Rice, polished . . . . .	0.01
Turnips . . . . .	0.09	Beef, all lean . . . . .	0.01
Eggs . . . . .	0.09	Patent flour . . . . .	0.025
Carrots . . . . .	0.08	Apples . . . . .	0.014

was from 10 to 11.5 mg. of calcium per 100 c.c. of blood serum, and these findings did not vary on repeated examinations of the same subject except during menstruation, when the serum calcium was always increased by about one mg. In patients with renal insufficiency the calcium values were often lower, but this was not a constant finding. In cases of hypertension without renal symptoms, the calcium values were within or but slightly above the normal range. In cases of asthma they were lower, and also in cases of hyperthyroidism. Among four patients with cancer the calcium values were subnormal in two cases and normal in the other two; while in one case of metastatic cancer in the bones it was especially high, *viz.*, 21.8 mg. per 100 c.c.

TEPLITZ<sup>†</sup> found that there is a decided loss of calcium from the blood in the terminal stages of pulmonary tuberculosis.

FEINBERG and LASH<sup>‡</sup> made studies of the blood calcium in cases of eclampsia and found no appreciable variations, although they state that on theoretical grounds a decrease in serum calcium would be expected.

In diabetic patients the potassium-calcium ratio is usually high. Kylin<sup>§</sup> found a high calcium value and a low potassium-calcium ratio in only one of his diabetic patients.

According to LESNÉ and TURPIN<sup>\*\*</sup> the spasm of tetany seems to be a syndrome in which an exaggerated neuromuscular excitability is combined with transient humoral changes. The chronaxia in the nerve and the muscle shows that the changes are similar to those induced by vasomotor disturbances due to chilling or to brief intoxication. These authors state that in these patients the reduction of calcium ions appears to be associated with disturbances of the acid-base balance of the plasma. This syndrome corresponds to that described by Bigwood<sup>\*\*</sup> as present in epilepsy. It is probable that the acid-base imbalance affects not only the nervous system, but also tissues of ectodermal origin. The functioning of organs which control the carbohydrate or protein metabolism may also be involved.

## CHRONIC TETANY

The theories which ascribe spasmophilia to the parathyroids, to the action of toxins, or to an excess or deficit of calcium, do not necessarily conflict, but the theory that it is due to a lack of calcium ions seems to have the most secure foundation of them all.

MACCIOTTA<sup>13</sup> studied the relationship of the thymus to tetany. He removed the thymus gland in one dog and in ten young rabbits, of which five survived. No tetany was produced, but on the other hand the calcium and magnesium concentration in the plasma rose, while their concentration in the tissues was lowered. From this he argues that a hyperfunction of the thymus might be one of the factors in tetany. The removal of parathyroids in his animals produced a fatal tetany.

KUROKAWA<sup>14</sup> has made extensive histological studies of normal and of pathological human parathyroid glands which are of such importance that it seems well to review them in some detail. Eight hundred and fifteen parathyroid glands from two hundred and forty human subjects, ranging in age from late fetal to eighty years, were studied. It was found that anatomically the parathyroids become larger with advancing years, their development being most marked at the period of adolescence. During fetal life the parenchyma cells are composed only of clear chief cells, but these cells begin to decrease in number at about the period of adolescence, and the dark cells begin to appear; in the adult the dark chief cells predominate. The clear chief cells contain a large quantity of glycogen, but no fatty substance; the dark chief cells contain a large quantity of fatty substance instead of glycogen; consequently the quantity of glycogen or of fatty substance is influenced by the number of each type of the chief cells. The oxyphils begin to appear at about the period of adolescence and tend to increase in number. These cells never contain more than a trace of glycogen or fatty substance. The time of appearance and the number of follicles and of colloidal formations are about the same as in the case of the oxyphils. The time of appearance of quantitative fluctuation of the dark chief cells and of the oxyphils coincides with the time when the development of the parathyroids is most marked, i.e., the period of adolescence. The oxyphils are larger than the chief cells and contain an abundance of stainable substances. The protoplasm and nuclei do not show any degenerative changes. The appearance of, or the increase in the oxyphils, is not accompanied with an increase of intercellular tissue, which may be regarded as an atrophic change. The oxyphils increase in number with advancing age, but this increase does not represent a senile change. The oxyphils appear in masses and often form nodules, some of which may be seen with the naked eye. The oxyphils appear at the time when the clear chief cells begin to decrease and the dark chief cells to increase, and they increase in number during pregnancy. These facts indicate that the oxyphils have some important function.

In status lymphaticus, lipomatosis and atrophy of the parenchyma with marked increase of the oxyphils occur. In beriberi in adults there is a marked increase of the clear chief cells. In infants the clear chief cells are hypertrophic. In chronic tuberculosis the increase of intercellular connective tissue is very marked (cirrhosis). In syphilis the picture is about the same as in cirrhosis. In cases of new growths as a rule the oxyphils are increased. In pregnancy also the oxyphils are increased. In sarcoma of bones, marked follicular formations are found.

HJORT, GRUHNZIT and FLIEGER<sup>15</sup> analyzed desiccated specimens of the parathyroids, the pituitary gland, the thymus gland and the ovaries of the ox, calf and hog, and found the iodin content of the parathyroids to be no greater than that of the other glands. The iodin found in these glands probably represents the normal distribution of the substance throughout the body tissues.

Interesting and valuable as are the findings and conclusions of the authors cited above, of especial interest in view of our own observations are the reports of various investigators regarding the relation of parathyroprival

## HENRY J. JOHN

tetany to calcium metabolism. The fact that the blood calcium in cases of tetany is decreased has been demonstrated by the work of the following authors: Berman, Lisser and Shepardson,<sup>16</sup> Snell,<sup>17</sup> Collip,<sup>18</sup> Cameron,<sup>19</sup> Fisher,<sup>20</sup> Hjort,<sup>21</sup> and Sherrill and Copp.<sup>22</sup>

GROVE and VINES<sup>23</sup> consider that the essential physiological rôles of the parathyroid glands are (1) a specific action on calcium metabolism; and (2) a generalized stimulating effect on body metabolism as a whole. They emphasize especially the rôle of the

### PROTOCOL III.

*Reaction of Normal Individual to the Injection of Parathormone  
(The Author—July 28, 1925)*

Time	Serum calcium mg. per 100 c.c.	Amount of parathormone injected	Symptoms
9:30 A. M. ....	10.5	5 units	
10:00 A. M. ....	....	....	
10:40 A. M. ....	11.5	....	
11:40 A. M. ....	3.5	5 units	Tinnitus aurium. Tingling fingers; headache; chill until 4 P.M.
The above symptoms not increased by the second dose.			
4:15 P.M. ....	12		All symptoms gone.

parathyroids in the fight against chronic infections, not by specific action on the infecting organisms, but by action on the tissue cells whereby the most favorable conditions for an adequate resistance is produced. Among the factors concerned in this process, the maintenance of proper calcium balance in the plasma is important. The majority of chronic diseases are due to the protracted absorption of toxic substances from a septic

### PROTOCOL IV.

*Reaction of Normal Individual to the Injection of Parathormone  
(The Author—May 4, 1926)*

Time	Serum calcium mg. per 100 c.c.	Amount of parathormone injected	Symptoms
9.00 A. M. ....	11	20 units	
9.30 A. M. ....			Headache.
10.15 A. M. ....			Pain in joints; nervousness; slight chill.
11.00 A. M. ....	11.5		Pain in joints increased and quite severe.
11.45 A. M. ....			Pain in joints increased; aching all over.
12-2 P. M. ....			Chill.
2.00 P. M. ....	11.5		
2.20 P. M. ....			Chill decreasing; temperature 100.
2.45 P. M. ....			Well.
4.45 P. M. ....	12		Well.

focus and such absorption is accompanied by a decrease in the ionic calcium in the blood, the parathyroid glands being the regulators of this calcium metabolism.

CAMERON and MOORHOUSE<sup>24</sup> consider that the direct cause of parathyroid tetany is a slight diminution (1-2 mg. per 100 c.c.) in the inorganic calcium of the plasma, which results indirectly from a diminution of the organic compounds. These authors suggest that the constancy of the blood calcium content depends on the slightly dissociable organic calcium compound which through a series of interlocked equilibria holds a definite amount of inorganic calcium in the plasma.

## CHRONIC TETANY

In his presidential address before the Clinical Congress of the American College of Surgeons in New York, October 20, 1924, CHARLES H. MAYO<sup>25</sup> made the following statement: "The loss of parathyroids leads to great elimination of calcium by the urine and by the intestines, and when the percentage of calcium is reduced below 7 milligrams for each 100 cubic centimetres of blood tetany supervenes, and guanidin toxins are found in the blood."

In our series repeated estimations of the serum calcium in normal individuals showed the calcium content to lie between 10.5 and 11 mg. per 100 c.c.

### PROTOCOL V.

*Reaction of Normal Individual to the Injection of Parathormone  
(Dr. P.—May 4, 1926)*

Time	Serum calcium mg. per 100 c.c.	Amount of parathormone injected	Symptoms
9:00 A. M.....	11		
11:00 A. M.....	12		
12-12:30.....		20 units	
2:00 P. M.....	12		
4:45 P. M.....	13		Slight reaction; slight pain in joints.

of blood serum. In definite cases of tetany the serum calcium ran as low as 4.5 mg. per 100 c.c. and in chronic tetany it was usually 8 mg. per 100 c.c. or above.

The calcium estimations here reported were made by the Tisdall method as described by Clark and Collip.<sup>26</sup>

Shortly after the use of parathormone was introduced, I noted that

### PROTOCOL VI.

*Effect of Parathormone on Serum Calcium.*

*(Case No. 149,261. Woman, thirty-eight years of age. Tetany first developed March 3, 1926, four days after thyroidectomy.)*

Time	Serum calcium mg. per 100 c.c.	Parathormone units
April 3, 1926    8.00 A. M.....	5.5	10
11.30 A. M.....	4.5	10
1.30 P. M.....	5	10
3.30 P. M.....	4.5	10
5.30 P. M.....	6	10

patients with chronic tetany would occasionally complain of a slight reaction after its administration which consisted in a feeling of depression and malaise, accompanied by pains in the joints. In these cases the serum calcium as estimated daily or every few days did not rise appreciably but rather maintained a fairly constant level between 9 and 10 mg. per 100 c.c. Because of these observations I was anxious to see what relation the variations in the serum calcium level from hour to hour after the administration of parathormone bore to the reaction. Therefore, on July 28, 1925, after estimating the calcium content of my own blood serum, which proved to be 10.5 mg. per

## HENRY J. JOHN

100 c.c., I took five units of parathormone intravenously. Within half an hour I began to hear ringing in the ears, which increased in intensity, and in forty minutes I felt a tingling in my fingers and had a severe headache, which was followed by a slight chill, which was not severe but lasted for several hours. The symptoms were much like those which are associated with the onset of a severe cold or with the reaction which follows the administration of a typhoid vaccine to one who is quite sensitive to it. An hour and

### PROTOCOL VII.

#### *Effect of Parathormone on Serum Calcium.*

(Case No. 157,614. Girl, seventeen years of age. Tetany first developed March 23, 1926, five weeks after thyroidectomy.)

	Time	Serum calcium mg. per 100 c.c.	Parathormone units
April 1, 1926	11.00 A. M.....	7	10
	1.00 P. M.....	7.5	10
	3.00 P. M.....	9	10
April 6, 1926	8.00 A. M.....	6.5	10
	10.00 A. M.....	7.5	10
	12.00 M.....	7.5	10
	2.00 P. M.....	7.5	10

ten minutes after the injection the serum calcium rose to 11.5 mg. per 100 c.c. and two hours and ten minutes after the injection, when the symptoms were most severe and I was obliged to lie down, the serum calcium was only 3.5 mg. per 100 c.c. Naturally, I did not know what my serum calcium content

### PROTOCOL VIII.

#### *The Effect of Parathormone and of Calcium Chloride on Serum Calcium.*

(Case 142,621. Woman thirty-one years of age. Tetany first developed January 22, 1925, three days after thyroidectomy.)

Time	Calcium chloride intravenously	Serum calcium mg. per 100 c.c.	Time	Parathormone units	Serum calcium mg. per 100 c.c.
Jan. 25, 1925 8.00 A. M.....	6 c.c.	3.5	June 30, 1925 9.00 A. M.....	10	5.5
10.50 A. M.....		6	10.10 A. M.....		5.5
11.50 A. M.....		7.5	11.10 A. M.....		5.5
12.50 P. M.....		6	12.10 P. M.....		4
2.50 P. M.....		5.5	1.10 P. M.....		5.5
4.50 P. M.....		5.5	3.10 P. M.....		6
6.50 P. M.....		9	7.10 P. M.....		7.5
			8.10 P. M.....		5.5

was at that time, and wanting to make sure whether or not my symptoms were actually due to the parathormone, I took five more units intravenously. The symptoms were not augmented after the second dose, but gradually became less and less, and in a few hours subsided entirely. I had to lie down for about two hours, but during the rest of the time I carried on my work. At 4.15 P.M., six and three-fourths hours after the first and four and three-fourths hours after the second dose, the serum calcium was 12 mg. per 100 c.c.

## CHRONIC TETANY

Thus after a primary rise of serum calcium there was a marked drop for which I am unable to account, this in time being followed by a rise to 12 mg. per 100 c.c. (Protocol III.)

The findings in this experiment, and a mass of data accumulated by estimations of the serum calcium in patients, were not sufficient to explain the observed phenomena and I, therefore, nine months later, on May 4, 1926, administered to myself 20 units of parathormone intravenously. (Protocol IV.) The serum calcium did not fall as in the first experiment, but I did experience a very severe reaction which started with pains all over the body, especially in the joints, a severe headache which was followed by a chill, in which my temperature rose to 100° F. All the symptoms disappeared in five

### PROTOCOL IX.

#### *The Effect of Intravenous Injection of Calcium Chloride on Blood Calcium.*

(Case No. 142,621. Woman thirty-one years of age. Tetany first developed after thyroidectomy.)

Time	8.00*	10.50	11.50	12.50	2.50	4.50	6.50
Bl. cal. mg. per 100 c.c. ....	3.5	6.0	7.5	6.0	5.5	5.5	9.0

\* 5 c.c. to per cent. CaCl<sub>2</sub> intravenously.

hours, but the chill was so severe that I was obliged to spend several hours in bed under blankets and with hot water bottles.

On the day on which I carried out this second experiment, an identical test was made on one of my colleagues, the same dosage of parathormone being used. The results of this test are shown in Protocol V. In this case also there was no fall in the blood calcium. The subject experienced a reaction, but it was very mild and lasted for only half an hour.

These three observations show that in normal individuals the serum calcium is increased after the administration of parathormone. That this is true in cases of tetany also is shown by Protocols VI, VII and VIII, although as one would expect, the increase is not as stable as in normal individuals. The effect of the intravenous injection of calcium chloride on the serum calcium is shown in Protocol VIII.

### CONCLUSION

1. From the literature and from personal observations and experiments we may draw the conclusion that parathyroprival tetany is due to a disturbance of the mechanism which governs the metabolism of calcium.
2. Parathormone appears to supply the essential element for the operation of this mechanism.
3. The series of cases of chronic tetany which have come under my observation show a serum calcium content of not less than 8 mg. per 100 c.c. up; while in acute tetany the lowest figure has been 4.5 mg. per 100 c.c. The normal range of serum calcium appears to lie between 10.5 and 11 mg. per 100 c.c.

## HENRY J. JOHN

4. Following the administration of parathormone there is an alleviation of symptoms and the calcium in the blood rises, although there is an alternating variation during the first few hours after its administration. The administration of parathormone to normal individuals results in a rise in the serum calcium content, accompanied by a reaction which may be quite severe, as in my own case. The symptoms of this reaction are similar to those which accompany the onset of an acute cold, *viz.*, headache, pains all over the body, pains in the joints, chill and fever.

5. While the symptoms of chronic tetany are relieved promptly by the administration of parathormone, in some instances they are relieved as promptly by the administration of normal saline, a fact which leads one to believe that there is a psychological factor in certain cases. It is therefore important for both the physician and the patient to attempt to find some criterion whereby to differentiate the onset of "false attacks" from "true attacks."

NOTE.—I wish to express my acknowledgment to Eli Lilly and Company for the liberal supply of parathormone which was used in this work.

### REFERENCES

- \* Denis, W., and Corley, R. C.: Effect of Excessive Calcium Ingestion on Calcium Content of Tissues With and Without Application of Ultra-violet Light. *J. Biol. Chem.*, 1925, vol. lxvi, pp. 609-617.
- \* Swingle, W. W., and Rhinhold, J. G.: Effect of Ultra-violet Radiation Upon Experimental Tetany. *Am. J. Physiol.*, 1925, vol. lxxv, pp. 59-69.
- \* Swingle, W. W., and Wenner, W. F.: Effect of Bleeding Upon Serum Calcium of Thyroparathyroidectomized Dogs. *Am. J. Physiol.*, 1926, vol. lxxv, pp. 372-377.
- \* Greenwald, I.: Effect of Administration of Calcium Salts and of Sodium Phosphate Upon Calcium and Phosphorus Metabolism of Thyroparathyroidectomized Dogs, With Consideration of Nature of Calcium Compounds of Blood and Their Relation to Pathogenesis of Tetany. *J. Biol. Chem.*, 1926, vol. lxvii, pp. 1-28.
- \* West, F., Bauer, J., and Barnickol, K.: Determination of Calcium and Thrombin in Serum. *J. A. M. A.*, 1922, vol. lxxviii, pp. 1041-1043.
- \* Anderson, W. T.: Some Researches on Calcium Content of Serum. *Hospitalstid.*, 1925, vol. lxviii, pp. 1177-1193.
- \* Tepitz, M. M.: Effect of Oral Administration of Calcium Lactate and Thyroid Extract on Calcium Content of Blood Serum in Pulmonary Tuberculosis. *Am. Rev. Tuberc.*, 1925, vol. xii, pp. 222-227.
- \* Feinberg, S. M., and Lash, A. F.: Blood Calcium in Eclampsia. *Surg., Gynec. and Obst.*, 1926, vol. xlii, pp. 255-258.
- \* Kylin, E.: Blood Calcium in Diabetes. *Zentralbl. f. inn. Med.*, 1926, vol. xlvi, pp. 79-80.
- \* Lesné, E., and Turpin, R.: Recent Clinical and Physiopathogenic Data on Spasmodophilia. *Presse méd.*, 1926, vol. xxxiv, pp. 1-3.
- \* Bigwood, E. J.: Blood Calcium Deficiency in Epileptics. *Compt. rend. Soc. de biol.*, 1924, vol. xc, pp. 98-100. Physical and Chemical Balance in Blood in Epilepsy; Calcium Ion. *J. de physiol. et de path. gen.*, 1924, vol. xxii, pp. 70-78; 94-108.
- \* Macciotta, G.: Function of Thymus in Pathogeneses of Tetany. *Policlinico*, 1925, vol. xxxii, pp. 589-606; abs. *J. A. M. A.*, 1926, vol. lxxxvi, p. 382.
- \* Kurokawa, K.: Histological Studies of Normal and Pathological Human Parathyroid Glands. *Japan M. World*, 1925, vol. v, pp. 241-251.
- \* Hjort, A. M.: Gruhzit, O. M., and Flieger, A. G.: Parathyroid Glands and Their Iodine Content. *J. Lab. and Clin. Med.*, 1925, vol. x, pp. 979-984.

## CHRONIC TETANY

" Berman, L.: Effect of Protein-free Acid-alcohol Extract of Parathyroid Glands Upon Calcium Content of Blood and Electrical Irritability of Nerves of Parathyroidectomized and Normal Animals. *Am. J. Physiol.*, 1926, vol. lxxv, pp. 358-365.

" Lisser, H., and Shepardson, H. C.: Tetany Parathyreopriva Treated With Collip's Parathyroid Extract. *Endocrinology*, 1925, vol. ix, pp. 383-396.

" Snell, A. M.: Parathyroid Extract in Treatment of a Case of Tetany. *J. A. M. A.*, 1925, vol. lxxxv, pp. 1632-1633.

" Collip, J. B., and Clark, E. P.: Further Studies on Physiological Action of Parathyroid Hormone. *J. Biol. Chem.*, 1925, vol. lxiv, pp. 485-507. The Internal Secretion of the Parathyroid Glands. *Proc. Nat. Acad. Sc.*, 1925, vol. xi, p. 484. A Parathyroid Hormone and its Physiological Action. *Am. J. Physiol.*, 1925, vol. lxxii, No. 1, pp. 182-183.

" Cameron, A. T., and Moorhouse, V. H. K.: The Action of Collip's Parathyroid Extract in Blood and Cerebral Spinal Fluid Calcium. *Trans. Royal Soc., Montreal*, 1925, vol. xix, pp. 29-43.

" Fisher, N. F., and Larson, E.: Effects Produced by Extracts of Parathyroid Glands on Normal and Parathyroidectomized Dogs. *Am. J. Physiol.*, 1925, vol. lxxv, pp. 93-106.

" Hjort, A. M., Robinson, S. C., and Tendick, F. H.: Extract Obtained from External Bovine Parathyroid Glands Capable of Inducing Hypercalcemia in Normal and Thyreoparathyroprivic dogs. *J. Biol. Chem.*, 1925, vol. lxv, pp. 117-128.

" Sherrill, J. W., and Copp, E. F. F.: Changes in Blood Serum Calcium Following Administration of Parathyroid Extract. *California and West. Med.*, 1926, vol. xxiv, pp. 183-188.

" Grove, W. R., and Vines, H. W. C.: Calcium Deficiencies: Their Treatment by Parathyroid. *Brit. M. J.*, 1922, vol. i, pp. 791-795.

" Cameron, A. T., and Moorhouse, V. H. K.: Tetany of Parathyroid Deficiency and Calcium of Blood and Cerebrospinal Fluid. *J. Biol. Chem.*, 1925, vol. lxiii, pp. 687-720.

" Mayo, Chas. H.: Calcium. *Surg., Gynec. and Obst.*, June, 1925, vol. xl, pp. 822-825.

" Clark, E. P., and Collip, J. B.: Tisdall Method for Determination of Blood Serum Calcium With a Suggested Modification. *J. Biol. Chem.*, 1925, vol. lxiii, pp. 461-464.

## THE PRINCIPLES UNDERLYING THE RATIONAL TREATMENT OF ACUTE OSTEOMYELITIS

BY ABRAHAM O. WILENSKY, M.D.

OF NEW YORK, N. Y.

FROM THE MOUNT SINAI HOSPITAL OF NEW YORK

IN A previous communication the mechanism of acute osteomyelitis was described. The essential parts of this mechanism, which was minutely described, include: (1) A bacteræmia or general blood infection; (2) a fixation point in the vascular network of a bone (thrombo-embolic phenomenon); (3) the development of a pathological process characterized by a thrombo-arteritis or thrombo-phlebitis; and (4) necrosis of bone cells and tissue. These four factors were found to be able to explain fully every type of pathology and of clinical fact that occurs with acute osteomyelitis.

In a second communication the röntgenographic appearances of acute osteomyelitis were correlated with the anatomical, pathological and clinical facts of this disease. The following classification could be established:

1. A group of cases of subperiosteal abscesses which are based on a superficial acute osteomyelitis in the cortex of a bone of slight grade and extent.
2. A group of cases of acute osteomyelitis in which the main stem of the nutrient artery forms the fixation point and becomes occluded by the thrombo-embolic process and in which as a consequence the entire diaphysis becomes involved in the pathological process; maximum lesions occur. This group is recognized röntgenographically by the sequestration of the entire diaphysis of the bone.
3. A group of cases of acute osteomyelitis in which one of the primary divisions of the nutrient artery is caught in the thrombus-embolus formation. These are recognized röntgenographically as well as during operation when the involvement of the shaft of the bone occurs through the entire thickness of the shaft at one end of the diaphysis approximately to one or the other side of the point of entrance of the trunk of the nutrient artery. Such cases are easily recognizable in the X-ray photographs.
4. A group of cases of acute osteomyelitis in which the thrombus-embolus formation occupies one of the secondary branches of the nutrient artery. These are recognized röntgenographically and during operation when the involvement of the diaphysis does not extend throughout the thickness of the shaft of the bone. These seemingly follow no rule in their development, are of irregular size and shape, frequently correspond to a thin shell of the cortex of the bone, occupy only a relatively small segment of the circumference of the bone and depend for their physical characteristics and röntgenographic appearances upon the position of the secondary branch, its importance in the intraosseous vascular network, and upon the possibilities of collateral circulation.

## TREATMENT OF ACUTE OSTEOMYELITIS

5. A group of cases of acute osteomyelitis in which the thrombo-embolic lesion is caught in the terminal part of an end vessel of the intraosseous vascular network. The röntgenological appearances of the finished lesion is that of a cavity in the bone (Brodie abscess).

These five groupings are typical of sharply demarcated lesions differentiated from one another by the location of the fixation point in the intraosseous vascular tree and based upon the consequence of the thrombo-embolic and thrombo-phlebitic process which forms the pathologic basis of all cases of acute osteomyelitis and of the consequent necrosis which occurs. These are recognizable in the röntgenographic evidences. Very frequently sharply demarcated lesions are not recognizable and these atypical and unclassifiable pictures depend upon two essential factors which are as follows:

A. The occurrences of cases of acute osteomyelitis in which more than one fixation point are formed either simultaneously or subsequently to one another, within the confines of a single bone, at each of which a typical thrombo-phlebitic lesion develops independently of the others. In the early stages of such a multiple pathological formation the lesions are distinct from one another and the röntgenographic appearances follow along the lines described in the previous five typical groupings. No further progression may occur. In many of the cases, however, the consequences of the initial thrombo-phlebitic lesion involve such an extensive part of the bone, that the several foci overlap one another primarily or coalesce subsequently at their peripheries and a fusion occurs of more than one lesion; a large atypical area of bone thus becomes involved. In such cases the individual foci lose their identity in the röntgenographic pictures and their nature can only be surmised.

B. The previously described conditions represent the end results of an uncomplicated initial lesion. Other changes and modifications of these underlying and essential anatomical and pathological facts and conditions are encountered in clinical, bedside and operating room observations; there are directly due to (1) the spreading characteristics of thrombo-phlebitic lesion in osseous tissue; (2) to the mutilations of the bone which necessarily accompany any osteotomy; (3) to combinations of both of these complicating factors; and (4) to exacerbations of infection of endogenous and exogenous origin. The various ways in which a thrombo-phlebitic lesion in bone (osteomyelitis) can spread, the directions which these various spreadings take place, and the consequences of the spreading of the essential thrombo-phlebitis or thrombo-arteritis of bone tissue with its resultant necroses have been minutely described on several previous occasions and will not be repeated here. Under these conditions the röntgenographic evidences lose their demarcating characteristics and atypical pictures result which are not possible of classification.

With these fundamental facts in mind it becomes apparent that in the treatment of acute osteomyelitis one has a twofold object to accomplish: (1) The treatment of the general infection (bacteriæmia—general blood infection as previously defined); and (2) the treatment of the local lesion.

ABRAHAM O. WILENSKY

TREATMENT OF THE BACTERIÆMIA

In any case a relative quantitative estimation of the magnitude of the infection can be established according to the number of colonies of bacteria which appear on the plate (plate culture method) in proportion to the amount of blood used to inoculate the culture medium in the plate. Thus, 1 or 5 colonies of bacteria per one cubic centimetre of blood as compared with 100, or an uncountable number of colonies of bacteria per one cubic centimetre of blood. This is a very rough method and is not strictly accurate, but for practical purposes the inaccuracy is inconsequential.

In practice the presence, or absence of a bacteriæmia or general blood infection, yield the following clinical groupings and the correct interpretation of the bacteriæmia in its relation to the clinical manifestations yield certain therapeutic indications:

*A.* Treatment of the general infection is many times not called for as, commonly, the natural protective agencies of the body are able to nullify the bacteriæmia and its effects. Many times, unless one understands the essential nature of the pathological process involved in the development of a focus of osteomyelitis, the question of the bacteriæmia does not enter into therapeutic consideration; this is so because as pointed out on previous occasions the bacteriæmia through which the focus of osteomyelitis was caused to develop was a temporary phenomena and sufficient time had elapsed between its appearance and the moment of observation to allow for its spontaneous disappearance. Under these circumstances there are no clinical or laboratory evidences of its existence. Good prognoses should be the rule under these circumstances. A reservation should, however, be made in one's mind to cover those cases of acute osteomyelitis in which for some undefinable reason as explained previously the thrombo-phlebitis begins to spread; in these positive blood cultures may later be obtained and the character of the illness changes entirely for the worse.

*B.* At the opposite end of the picture are those fulminating, progressive and severe forms of bacteriæmia and general blood infection, the existence of which is associated clinically with a symptom complex in which the local focus of osteomyelitis is of minor and secondary consideration and in which the bacteriæmia or general blood infection is the dominating factor in the entire clinical picture. Large numbers of viable organisms are demonstrable in the blood cultivations in such severe cases. The local focus may exhibit definite signs of its presence, or may be unrecognizable and undemonstrable owing either to the paucity of its clinical manifestations or to the profound intoxication produced by the general blood infection.

Any kind of local condition may be associated with such general blood infection. It is to be assumed under such conditions that large numbers of viable organisms are being discharged into the blood stream from the thrombo-phlebitic lesion and that the bacteria are multiplying in the blood also; the prognosis must therefore be a very serious one. The usual course of affairs includes a steady progression of the general blood infection until a

## TREATMENT OF ACUTE OSTEOMYELITIS

fatality occurs. Under these circumstances treatment directed to the local lesion is futile and fatalities are the rule and not the exception. One must understand that here one is dealing with cases of general blood infection and any treatment which is possible and permissible must be directed to the general infection; the local lesion plays a minor rôle. The premise that operation on the focus of osteomyelitis "furnishes to the unfortunate patient his only chance" is sometimes something which may not be refused in the presence of anxious parents and relatives; but whenever such earnest desires are acceded to, it should be unequivocably emphasized that the "chances" are practically nil. In the fulminating cases the entire duration of the illness is most often a question of a few days.

There are other somewhat less severe forms of acute osteomyelitis in which the blood contains large numbers of viable organisms, but in which the clinical picture does not carry with it that comparatively sudden overwhelming of the body with a profound toxæmia. Following operation there is little or no lessening in the magnitude of the bacteræmia or, possibly, an increase in the latter. Under these circumstances the question of amputation should be discussed when the local conditions lend themselves thereto.

C. In between the mild cases of group *A* and the very severe cases of group *C* there exist large numbers of cases of acute osteomyelitis in which (1) there are well-marked evidences of one or more foci of acute osteomyelitis and (2) a demonstrable bacteræmia.

Blood cultures obtained under these circumstances can be employed: (*a*) in appropriate cases as an additional means of differential diagnosis; (*b*) as means by which the severity of the infection can be gauged; (*c*) as a help in estimating the prognosis; (*d*) as criteria upon which to base the primary or further operative treatment.

Occasionally the character of the organism demonstrated in the blood culture can be employed as a differential point in diagnosis. Cases are constantly being seen in which it is difficult to decide whether the localization has occurred in a bone or in a neighboring joint. True enough this sometimes indicates a simultaneous involvement of both, but in other cases the localization is hidden in a general inflammatory reaction. Under these circumstances the demonstration of organisms of the staphylococcus group—*staphylococcus aureus* especially—indicates that the chances are greatly in favor of a bone involvement; the demonstration of organisms of the streptococcus group would speak in favor of a joint involvement. The differentiation carries with it a possible therapeutic indication. Other things being equal, the demonstration of organisms of the staphylococcus group with its consequent interpretation of a bone lesion would ordinarily favor exploration of the bone in cases of doubt; while the demonstration of organisms of the streptococcus group would carry with it a more conservative attitude at least as far as exploration of the bone were concerned.

In cases of acute osteomyelitis the relative magnitude of the bacteræmia

ABRAHAM O. WILENSKY

or general blood infection is capable of yielding information valuable for a correct gauging of the prognosis. This information can be classified as follows:

A. In cases of acute osteomyelitis blood cultures showing one or two colonies of organisms to the cubic centimetre of blood are usually but not always of a mild nature, frequently show little or no evidence of their existence, are associated with symptom complexes which do not differ materially from similar cases of acute osteomyelitis in which the blood cultivations are sterile, and frequently disappear spontaneously or following operation. Good prognoses are the rule in these minor bacteriæmias.

B. On the other hand blood cultures can be obtained in which the numbers of colonies are extremely large—100 or more colonies to the cubic centimetre of blood. Always this indicates a severe infection and an extremely grave prognosis. The clinical picture commonly shows an equal evidence of the severity of the infection. The interpretation of such blood cultures has been referred to already in considering the fulminant cases of acute osteomyelitis. There will be many cases in this group in which one will have no doubt as to the need for operation upon the local focus of osteomyelitis and one will proceed confidently on these. There will be many other cases in this group in which one will be somewhat in doubt as to the correct interpretation of the relationship of the clinical picture to the bacteriæmia or general blood infection, especially in those cases bordering upon the fulminant cases referred to previously. Under such circumstances one must operate upon the local demonstrable focus of osteomyelitis and remove it radically.

C. In between these two extremes are large numbers of cases in which the blood cultivations show an intermediate number of colonies of bacteria. When a given blood culture is compared with subsequent ones taken on the same patient the lessening of the number of colonies, or their disappearance, undoubtedly bespeak an improvement when other conditions are equal; an increase in the number of colonies should always be cause for alarm and for a prompt reconsideration of the available clinical picture and revision of all of the demonstrable foci of infection, whether they be in the bone or in other tissues and organs. Comparisons made along these lines are of extreme usefulness and importance in bedside and operating room work. In any event it will usually, but not always, be found that the bacteriological data correspond quite closely with the variations in the demonstrable subjective and objective clinical picture.

D. In the presence of a positive blood culture a prognosis of the ultimate outcome in cases of acute osteomyelitis cannot always be made on the basis of the blood culture findings alone and should not be attempted, except after consideration of all of the available clinical facts. While a positive blood culture is always a serious thing, especially from the point of view of the possibilities which may occur, it is usually found that the seriousness of the latter is paralleled by the characteristics of the clinical picture. The prognosis

## TREATMENT OF ACUTE OSTEOMYELITIS

should always be guarded. Much depends upon the availability of the local focus of osteomyelitis for thorough surgical removal and upon the performance of the latter procedure before other complicating foci have appeared.

E. Negative (sterile) blood cultures obtained either primarily or secondarily in cases of acute osteomyelitis should not always be associated in one's mind with the milder type of case or with improvement. Quite the contrary can be the case and negative blood cultures can be obtained in the presence of the most severe infections. The available clinical data indicate that the demonstration of a sterile blood culture may be an accident and be associated with the intervals between temporary states of bacteriæmia; the occurrence of complicating and secondary foci, other than the bone focus and subsequently to it, in the presence of negative blood cultures is the most powerful proof of these temporary bacteriæmias.

In the presence of positive and negative blood cultures a progressive impoverishment of the general condition of the patient is frequently due to the magnitude and number of the various fixation points that have occurred or to their location in important viscera or localities of the body rather than to the presence of the blood infection. Positive blood cultures are sometimes only obtainable at a late stage of the illness. Death results either from a general progression of the entire infection or from the results of any one particular manifestation as, for instance, from the results of a localization in the lungs and pleura.

In any given case the presence of a bacteriæmia may be referable (1) to the original primary lesion, (2) to its secondary focus in the bone, (3) to the presence of a focus subsidiary to the secondary focus (to one or other) which by itself is capable of creating a bacteriæmia, (4) to the presence of a valvular lesion arising in some way from the presence of a bacteriæmia, and (5) to the presence of some other complication capable itself of giving rise to a bacteriæmia or general blood infection.

Except in cases of acute osteomyelitis which follow specific infections as typhoid fever, pneumococcus pneumonia, etc., and in which the bone foci make their appearances during the course of the primary illness, the primary lesion to which the focus of osteomyelitis is secondary is not recognizable or demonstrable by the ordinary clinical or laboratory means. In the average case seen the question of the primary lesion does not enter.

In practice one should assume that the bacteriæmia is most likely derived from one or other of the demonstrable bone foci.

Under these circumstances the treatment of the bacteriæmia or general blood infection must be the surgical removal of the focus containing the thrombo-arteritis or thrombo-phlebitis from which the bacteriæmia or general blood infection is derived.

The bacteriæmia should be considered as an indication for immediate operation, and its presence and magnitude as a measure of the urgency with which surgical intervention is called for.

ABRAHAM O. WILENSKY

THE TREATMENT OF THE LOCAL LESION

The treatment of the local lesion of acute osteomyelitis should be based (1) upon a consideration of the mechanism by which the foci are produced; (2) upon the character of the lesion which is produced, as determined by the available knowledge and by röntgenographic evidence; and (3) in accordance with the magnitude of the infection in association with the absence or presence of bacteraemia. Multiple foci of osteomyelitis should be treated individually along similar lines and in accordance with the viewpoints expressed.

*A.* Other things being equal, the absence of a demonstrable bacteraemia or general blood infection indicates that a conservative attitude can be assumed in deciding the correct method of surgical treatment of the local focus of osteomyelitis.

Under these circumstances the immediate indication to be met is the introduction of adequate drainage; thereafter one should await the full demarcation of the lesion by the natural sequestration which will occur as indicated in the previous part of this and in other communications. The immediate importance of this conservative attitude comprises (1) a much less severe—frequently, indeed, a minor—primary operation; (2) the much less chance of spreading the thrombo-phlebitic or thrombo-arteritic process with all the consequences hereinbefore outlined; (3) the frequent conservation of important bone tissue; (4) the frequent avoidance of unnecessary complications; (5) the ease with which the sequestrotomy can be subsequently performed without undue mutilation of the bone; (6) the lesser chance of secondary and operatively produced spreading of the lesion; (7) the lesser degree of deformity which results; and (8) the greater usefulness of the limb because of less interference with the normal range of motion.

The actual method of introducing drainage into a focus of osteomyelitis depends upon general surgical principles. These comprise (1) the simple opening of subperiosteal abscesses in appropriate cases; and (2) the various forms of osteotomy in which openings are established into the medulla of the bone. In any case free drainage should be provided.

In performing the secondary sequestrotomy only as much healthy bone or involucrum should be removed as to enable one adequately to remove the sequestrum. The main care is not to cause undue mutilation and to prevent the spread of the thrombo-phlebitis inasmuch as this is the chief cause for the subsequent exacerbations or recrudescences in the same focus or in the production of other foci. The resulting wounds should not be sutured and should be allowed to heal from the bottom, either with or without the aid of sterilization by the Carrel-Dakin method.

*B.* Other things being equal, the presence of a demonstrable bacteraemia or general blood infection indicates a dangerous and possibly progressive lesion and bespeaks an urgency of effort which seeks to remove the guilty local focus as early and as completely as possible before irreparable damage is done by the spreading of the infection to the endocardium or other impor-

## TREATMENT OF ACUTE OSTEOMYELITIS

tant organ or locality. All of the information classified in the previous part of this and in other papers as regards the clinical and the therapeutic significance of a bacteriæmia or general blood infection accompanying an acute osteomyelitis come into play at this time and judgments should be based and indications met accordingly.

The important indication is to remove the local focus of osteomyelitis as completely as possible. Conservatism should be replaced by the radical removal of bone tissue frequently into healthy areas. The difficulty at these early stages is the impossibility of being able to recognize the limits of the lesion and much wider excisions of bone tissue must therefore necessarily be done than would otherwise be called for. There are times and localities in which radical removal of the thrombo-phlebitic focus in the bone is not technically feasible; under these circumstances as much as possible should be done in this direction, ample drainage should be secured as the next best thing, and a good deal must be entrusted to nature's efforts in spontaneously dissipating the bacteriæmia.

The clinical possibilities which follow operation and the therapeutic indications which are available are the following:

a. In many of the cases a single focus of osteomyelitis only is demonstrable. In most of the cases in this group, the comparatively small number of bacteria demonstrable in the blood circulation (plate culture method) indicates the probability that the bacteriæmia results from the demonstrable local lesion. If following an adequate operation in which the demonstrable focus of osteomyelitis is removed, the blood becomes sterile, the pre-operative assumption that the bacteriæmia had resulted from that particular focus of osteomyelitis becomes confirmed. In some of the cases, however, the bacteriæmia persists after operation. When the surgeon is certain that the bone lesion has been so thoroughly removed as to be impossible of causing the bacteriæmia and when the appearances of the bone wound corroborates this impression, the bacteriæmia should be used as an indication that some other focus exists which must be found and removed in order to render the blood sterile. Many times this proves to be the case; but when it does not the original focus of osteomyelitis should be examined again and revised operatively. If the bacteriæmia still persist and the number of demonstrable bacteria is still comparatively small, other foci or lesions capable of causing a bacteriæmia should be looked for. In the absence of any such demonstrable lesion, the explanation of the bacteriæmia cannot be decisive, although it must necessarily be assumed under the circumstances that the original focus continues to discharge bacteria into the blood stream and one should constantly be on guard and act accordingly. Undoubtedly in some cases an obscure primary lesion exists which serves to keep up the bacteriæmia. In the meanwhile other foci should be looked for, especially during the continuation of the bacteriæmia. Fortunately in most of the cases the natural forces of the body are ample after a sufficient elapse of time to render the blood sterile.

ABRAHAM O. WILENSKY

b. When several foci of osteomyelitis coexist in the presence of a bacteriæmia, the explanation of the latter becomes a matter of exclusion. Similar rules to those outlined in the last paragraph apply.

c. In a few of the cases, comparatively speaking, the primary lesion is demonstrable as well as one or more subsidiary bone lesions. In the majority of the cases, the primary bacteriæmia disappears after efficient surgical treatment directed towards all of the demonstrable lesions, primary or other. In a few cases, however, the bacteriæmia persists. Although in some of the latter cases, because of the character of the infecting organism, or because of other reasons, it is possible to say with a fair degree of certainty that the primary lesion is keeping up the bacteriæmia, in all of the others, the proper explanation becomes a matter of exclusion also in accordance with the rules laid down.

d. In some of the cases of acute osteomyelitis with bacteriæmia a subsidiary focus has developed in a tissue or organ other than bone, or a complication develops which is unrelated to the osteomyelitis. Except in those cases of complication in which the latter is known from previous experience to cause a bacteriæmia or general blood infection, the proper explanation again becomes a matter of exclusion as previously indicated.

e. In any case in which the question of the bacteriæmia cannot be adequately explained, and in which it continues to exist, a bacterial endocarditis should be looked for. The presence of the latter is the most serious complication possible and a very grave prognosis should be made; operation upon any local focus is futile in the presence of a bacterial endocarditis and a fatal outcome should be expected.

Many of the statements made in the last classification are equally applicable before operation. At any time, either before or after operation, patients in the first four groups of this classification may progress into the group of most severe and fulminant cases. They then assume the characteristics of the cases in this group and the clinical manifestations increase in gravity proportionately and absolutely. Similar therapeutic indications exist as were previously pointed out. It is very rare for the opposite course to be followed. This change has intimate relations with a spread of the thrombo-phlebitis as previously referred to and may occur spontaneously either before or after operation or as a consequence of the latter. The possibility of this change occurring spontaneously before operation in cases of acute osteomyelitis, even when previously a sterile blood culture had been obtained, is the chief reason for considering cases of acute osteomyelitis emergency cases which brook of little or no delay before operation. On the other hand, this can occur subsequently and at comparatively late periods and even be associated with so-called exacerbations or recrudescences in healed foci of osteomyelitis.

The phenomena accompanying the spread of the thrombo-phlebitis are particularly apt to occur after operation. They characterize a group of cases of osteomyelitis which directly after operation do not exhibit the expected

## TREATMENT OF ACUTE OSTEOMYELITIS

retrogression and disappearance of the local inflammatory effects and a subsequent healing, but which, instead, show an increase, large or small, in the local focus. Exhibiting the same characteristics of the early unoperated cases of osteomyelitis, the röntgenological evidences of these phenomena are not immediately visible and are recognizable only later when the full effects of the increase in the thrombo-phlebitic process has become sufficiently established. Clinically, these are recognizable by the continuation of the subjective phenomena or by recrudescences or exacerbations of the process. Inasmuch as the essential mechanism of these post-operative phenomena are similar to those which occur spontaneously and before operation, similar results follow. All of the characteristic phenomena which have been described in the previous part of this and in other communications as regards the spreading of the original foci or the formation of additional foci within the confines of the same bone, can and do occur post-operatively and are a direct consequence of the operation. In this respect it is to be emphasized that the characteristics of the thrombo-phlebitis are aided and abetted by the operative manipulations and that the latter play a rôle only in this way. It must be further emphasized that in no other way could the extraordinary and bizarre effects which are clinically seen to interfere with the control of the process and to disturb the smoothness of the healing of the wound be satisfactorily explained.

Other factors enter into the problem when joint complications occur and when epiphyseal lines become part of the focus of infection, especially in younger individuals. Absorption phenomena and disturbances of growth then take place which are important factors in determining the end results of the focus of infection. The discussion of all these problems is reserved for another communication.

The experiences upon which the viewpoints and conclusions of this communication are based are derived from clinical observations upon patients admitted to the service of Dr. A. V. Moschcowitz at Mount Sinai Hospital and upon patients in my own private practice. I am indebted to Doctor Moschcowitz for permission to make these observations upon the patients admitted to his service.

## FAT NECROSIS OF THE BREAST

A STUDY OF TWENTY CASES

BY J. GOTTESMAN, M.D.

AND

A. PHILIP ZEMANSKY, JR., M.D.

OF NEW YORK, N. Y.

FROM THE MONTEFIORE HOSPITAL AND THE LABORATORIES OF MT. SINAI HOSPITAL, OF NEW YORK CITY

THE recognition of fat necrosis of the breast is important because of its close similarity to carcinoma both clinically and in gross pathological appearance. This subject was first studied comprehensively by Lee and Adair<sup>1</sup> in 1920, under the title "Traumatic Fat Necrosis of the Breast." In 1924, these authors<sup>2</sup> reviewed the twenty reported cases, and gave a complete description of this condition.

All the cases are said to occur in obese women and usually to follow some direct trauma to the breast. A mass develops within the breast, or in the subcutaneous tissue overlying it. This mass is usually painless. It is at first freely movable, but as the process progresses, fixation of the tumor to the surrounding tissues results. The nipple is seldom retracted, a fact which helps in the differentiation of this condition from malignancy. The axillary and supraclavicular nodes are seldom palpable.

Ewing<sup>2</sup> describes the pathological differentiation of this benign lesion from cancer as follows: "In traumatized fat the nodules are irregularly distributed throughout the breast and fade into the surrounding breast tissue, while carcinomatous nodules occur singly and are sharper in outline. The newly formed connective tissue of fat necrosis is red, due to the formation of fine capillaries which are absent in carcinoma. Later, cicatrization obliterates these capillaries and the connective tissue of fat necrosis becomes as dense and opaque as in carcinoma. On section, the fat cells lying in cicatricial connective tissue resemble the small alveoli of carcinoma. The presence, however, of fibroblasts, mingled with lymphocytes, empty fat spaces, phagocytic giant cells and wide areas of proliferating fat cells, helps to differentiate this condition from cancer."

In our series, the most striking and characteristic histological findings were disorganized fat cells, invaded by newly formed connective tissue, with deposits of fatty acid crystals, often taking the typical rosette form. Surrounding the fat crystals were numerous small and large giant cells of the foreign body type. At the periphery of the lesion young proliferating fat cells and cells laden with pigment were often found.

Farr,<sup>3</sup> in 1923, was able to reproduce experimentally the characteristic lesion of fat necrosis by pinching the subcutaneous fat of pigs with forceps. Sections made of the injured areas showed the typical histological picture of fat necrosis, and in freshly stained preparations fatty acid crystals were

## FAT NECROSIS OF THE BREAST

readily demonstrated. From his studies he concluded that in an area of traumatized fat, the lipolytic enzyme present in all normal body fat and blood, is liberated, and acts upon the neutral fat in the traumatized area, breaking it down into its component parts, fatty acid and glycerol. These substances form the irritant which give rise to the foreign body reaction, producing the lesion of traumatic fat necrosis.

A case of undoubted fat necrosis recently came to our attention in which trauma could not be considered as the etiological agent (CASE VIII). It occurred to us, after a study of this case, that a critical examination of the cases of fat necrosis on record at the Mt. Sinai Hospital and a review of a series of breasts removed for non-malignant conditions might throw further light on the etiology of this condition. Seventy-eight cases in all were studied, and in fourteen of them some stage or degree of fat necrosis was found. A clinical analysis of these cases presented certain interesting facts.

*Age*.—The age incidence in our series ranged from nineteen to sixty years, but the majority of cases occurred in the fourth and fifth decades of life, falling within the so-called cancer age.

*Obesity*.—Six cases have a definite history of general obesity and unusually fatty breasts. Two cases are definitely recorded as not obese, and in one case the patient was emaciated.

*Pain*.—The breast was the seat of pain in six cases, in four of which the breast tissue showed some other concurrent pathological condition besides that of fat necrosis.

*Consistency of the Tumor*.—The tumor was of stony hardness in twelve of the cases and in one case it fluctuated.

*Fixation to the Skin*.—Skin fixation was present in five cases, and noted as absent in seven cases.

*Nipple Retraction*.—This phenomenon occurred but once in the series.

*Size and Situation of the Mass*.—The lesion varied in size from 1 mm. to 5 cm. in diameter and was not confined to any particular quadrant of the breast.

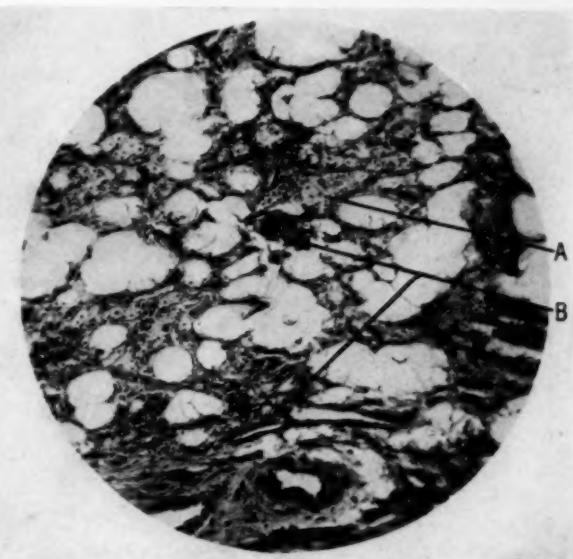


FIG. 1.—From a case in Group 1, showing disorganized fat tissue invaded by connective tissue. A. New formed fat cells. B. Giant cells.

*Trauma.*—A positive history of trauma to the breast preceding the formation of the lesion was obtained in only one out of our series of fourteen cases. In two others the lesion followed a surgical procedure. Of these, one case occurred soon after a radical mastectomy and simulated recurrent carcinoma in the operative scar. The other case developed in the scar of a previous incision for a breast abscess. In three of the cases there is only questionable evidence of trauma to the breast, such as application of a hot compress for a short while, a fall five months before the development of the lesion or an accident during which a contusion of the hip was sustained. In seven cases the histories definitely state that there was no trauma preceding the development of the lesion in the breast. In one case, the history contains no reference to the question of trauma.

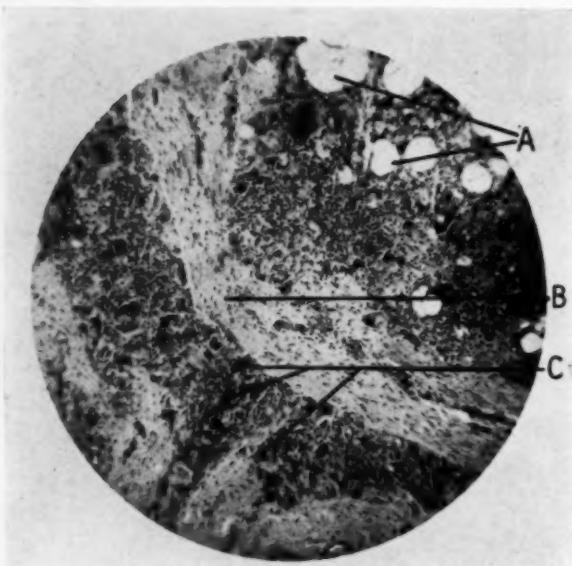


FIG. 2.—From a case in Group 2, Showing A, empty fat spaces and B, dense connective tissue. C, Giant cells.

*Group 2.*—Fat necrosis occurring as a single tumor mass in an otherwise normal breast. (Figs. 2 and 3.)

*Group 3.*—Fat necrosis occurring as multiple punctate areas in a breast the seat of some other pathological process. (Figs. 4, 5, 6.)

*Group 4.*—Fat necrosis occurring in a lipoma of the breast. (Fig. 7.)

#### REPORT OF CASES

*Group 1.*—Fat necrosis occurring in the subcutaneous tissue overlying the breast. Three cases.

**CASE I.**—A. G., aged fifty-two, admitted to the Mt. Sinai Hospital, March 4, 1925, complaining of lumps in the right breast and right inguinal region. Patient is married and has five children. Two weeks before admission, patient fell and sustained a contusion of the right hip. A week later she noticed enlarged inguinal glands on the right side. Five days before admission she noticed a mass in the right breast which was painless.

The general physical examination was negative. In the right breast, 4 cm. above the nipple, there was a small firm nodule apparently attached to the deeper tissues. The overlying skin was freely movable. The nipple was not retracted; axillary nodes were not palpable. In the right inguinal region, a few hard lymph-nodes were palpated.

*Operation.*—Under gas and ether, a hard nodule, 2 cm. in diameter, embedded in fat

## FAT NECROSIS OF THE BREAST

was removed from the breast. At the same time, a mass about 5 cm. in diameter, was excised on the right side above Poupart's ligament.

*Gross Description.*—The mass removed from the breast consisted of fat showing scattered areas of firmer consistency arranged in a radial manner, and on section presented a dull grayish-white color, with small cystic and hemorrhagic areas.

*Microscopic Report.*—Fat tissue showing fat necrosis. It is interesting to note that the mass in the inguinal region was also fat necrosis.

CASE II.—E. S., aged forty-two, admitted to the Mt. Sinai Hospital, January 3, 1921, complaining of a lump in the scar of a previous operation. Seven weeks before admission, patient had a radical mastectomy for a tumor of the right breast, which was reported inflamed and degenerated medullary carcinoma. For the past two weeks patient had noticed pain in the axillary portion of the scar on moving the arm, and noticed the appearance of a slowly growing lump.

The general physical examination was negative except for marked obesity. The upper axillary portion of the scar was nodular, infiltrated and appeared to be attached to the chest wall. This area was neither red nor tender. No enlarged lymph-nodes were to be felt and there were no nodules in the surrounding skin.

*Operation.*—Under the diagnosis of recurrent carcinoma, excision of the nodule with the surrounding skin was carried out. The mass was adherent to the chest wall and the axillary vein. A small amount of pus escaped during the dissection, the exact source not being determined.

*Gross Examination.*—Specimen consisted of resected portion of tissue measuring about 15 cm. in diameter, including old scar from previous operation. There was marked infiltration of the subcutaneous tissue in the region of the scar, which on section appeared cellular and fibrous, suggesting recurrent carcinoma.

*Microscopic Report.*—Section contained skin, sebaceous glands, hair follicles and surrounding fat. The skin was negative. Fat tissue showed typical fat necrosis.

CASE III.—D. F., aged thirty-five, applied to her local physician, complaining of a lump in the breast. A year and a half ago, patient noticed a small lump in the right breast. She was attended by a local physician, who incised what appeared to be an abscess and packed the wound. The wound healed slowly, requiring several months for complete closure. After healing, a small nodule was left, which persisted up to the present illness. Since the previous operation, a small superficial lump remained in the skin over the breast, not tender, not increasing in size.

The general physical examination was negative. In the skin of the right breast, there was a small nodule, 1 cm. in diameter, hard but not tender; freely movable on the underlying structures.

*Operation.*—Under local anaesthesia, the nodule with the surrounding tissue was excised. At operation, the lesion appeared cystic.



FIG. 3.—From a case in Group 2, showing A, fat crystal deposit. B, pigment containing cells on periphery and C, giant cells.

*Microscopic Report.*—Section consists of skin and subcutaneous fatty tissue. Directly beneath the skin, there was a circumscribed area of typical fat necrosis, about 5 mm. in diameter, with some atypical proliferation of surface epithelium into it.

*Group 2.—Fat necrosis occurring as a single tumor mass in an otherwise normal breast. Five cases.*

CASE IV.—E. N., aged fifty-four, was admitted to the Mt. Sinai Hospital, June 6, 1923, complaining of a lump in the right breast. Six months ago, a tumor of the left breast, which occurred after a trauma, was removed. This was reported typical fat necrosis and

was included in the series reported by Lee and Adair. For the past four weeks, patient noticed a lump in the right breast, which was neither painful nor increasing in size. There was transient redness of the skin over the area. Patient had no fever or chills, and remembers no distinct trauma to the breast.

The general examination was negative. In the upper and outer quadrant of the right breast, there was a small nodule about the size of a pea. The nodule was tender with an area of softening about it.

*Operation.*—Under local anaesthesia, two small nodules, each the size of a pea, were shelled out. They were firm, yellowish in color, and on section

FIG. 4.—From a case in Group 3, showing A, dilated duct; B, diseased breast acini; C, area of fat crystal deposit.

showed small whitish areas. *Microscopic Report.*—Section contained small fragments of breast tissue and surrounding fat. Breast tissue showed no lesion. Fat tissue showed typical fat necrosis.

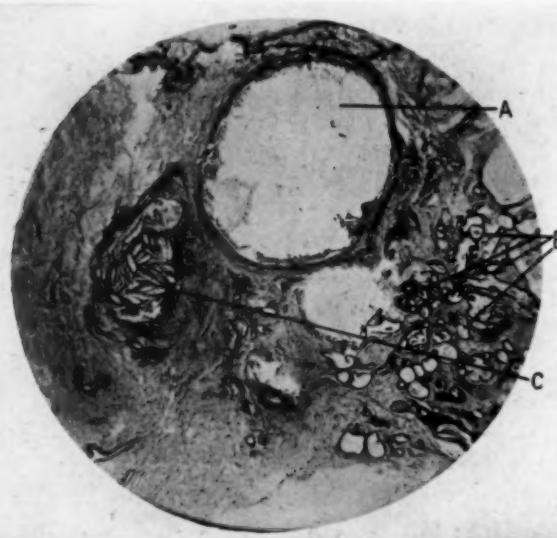
CASE V.—R. K., aged sixty, was admitted to the Mt. Sinai Hospital, October 26, 1925, complaining of a lump in the left breast. Patient is married, and has had several pregnancies. Artificial menopause fifteen years ago following hysterectomy. Three weeks ago patient noticed redness of the left breast, about 3 cm. above the nipple. This directed her attention to a lump in this situation which was not painful. Patient attributed the presence of this lump to a fall sustained five months previously.

The physical examination was negative. In the left breast, in the mid-clavicular line above the nipple, there was a flattened, hard, non-tender mass, about 2 cm. in diameter. The mass moved with the skin, and seemed to be attached to it. It was not, however, attached to the deeper structures. There was one small hard lymph-node in the left axilla.

*Operation.*—Under local anaesthesia, the mass above described was excised, appearing grossly like altered fat.

*Microscopic Report.*—Section consists for the most part of breast tissue, showing changes coincident with involution. Surrounding fat shows the typical picture of fat necrosis.

CASE VI.—R. F., aged sixty, was admitted to the Mt. Sinai Hospital, April 9, 1926, complaining of swelling and tenderness in both submaxillary regions. Patient is married, and has several children. For the past few weeks, patient had noticed swelling and



## FAT NECROSIS OF THE BREAST

tenderness of the submaxillary glands without fever or constitutional symptoms. She did not complain of any symptoms associated with her breasts.

The general physical examination was negative. Both submaxillary glands were swollen, painful and tender. During the examination, a lump about 1 cm. in diameter, was discovered in the left breast. There was no history of trauma to the breast.

*Operation.*—Both submaxillary glands were excised and reported chronic inflammation. A week later, a local excision of the breast tumor with surrounding breast tissue was carried out.

*Gross Description.*—Specimen consisted of breast tissue, measuring  $7 \times 7 \times 3$  cm. in

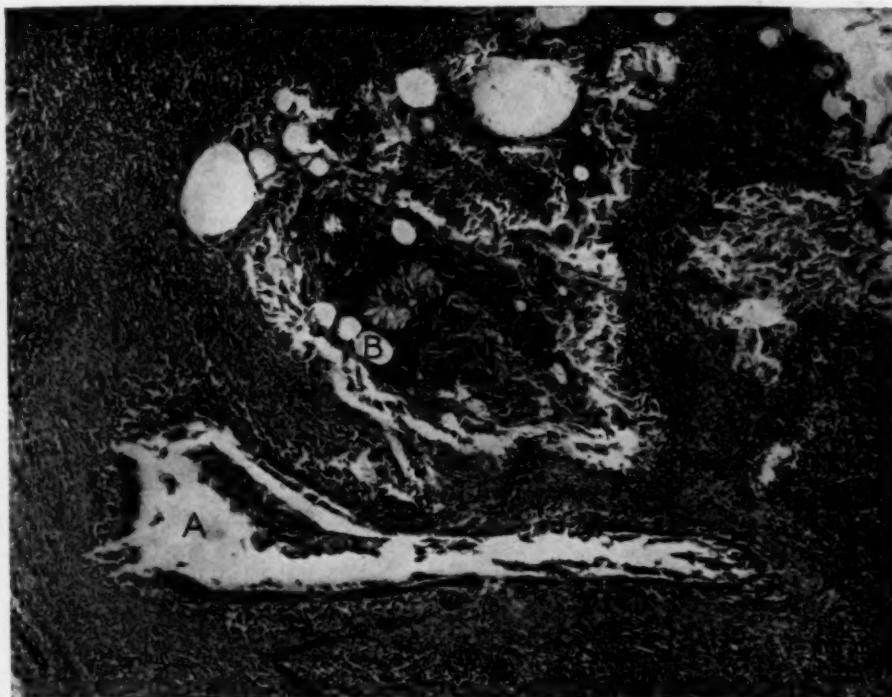


FIG. 5.—From a case in Group 3, showing, A, dilated duct with defective wall. B, adjacent area of fat necrosis containing rosette of fat crystals.

diameter, of brownish color, which on section cut with a grating sound and glistened as from a surface of myriads of tiny lenses.

*Microscopic Report.*—Sharply demarcated from surrounding breast and fatty tissue was an area of fatty acid crystals, each clump of crystals being surrounded by inflammatory reaction typical of fat necrosis. Surrounding this area, there were large numbers of cells laden with pigment.

**CASE VII.**—D. L. B., aged fifty-six, was admitted to the Montefiore Hospital on April 6, 1926, complaining of a lump in the right breast. Patient is married, and has four children, living and well. Six months before admission, patient fell down a flight of stairs, striking the right breast. The right breast immediately became swollen and discolored. Several days later, the patient noticed a hard mass in the upper and inner quadrant of the right breast, which grew rapidly to the size of a hen's egg and then diminished somewhat in size. The mass was not painful.

The general physical examination was negative except for marked obesity. In the upper and inner quadrant of the right breast, there was a hard, plum-sized mass which

GOTTESMAN AND ZEMANSKY

was freely movable on the skin and deeper tissues. There was no discoloration of the skin, retraction of the nipple or palpable axillary lymph-nodes.

*Operation.*—Under local anaesthesia, enucleation of the tumor mass from the surrounding breast tissue was performed.

*Gross Description.*—Specimen consists of fatty tissue containing scattered islands of soft, yellow material, studded with minute foci of yellowish necrosis.

*Microscopic Report.*—Fatty tissue showing typical fat necrosis.

CASE VIII.—X. Y., aged forty-six, admitted to Flower Hospital, April 22, 1926, complaining of a lump in the left breast. The patient is married, with several children



FIG. 6.—From a case in Group 3, showing, A, dilated duct with defective wall. B, periductal inflammatory changes. C, areas of necrosis.

living and well. Two weeks before admission patient noticed pain in the left breast. She applied hot compresses to it, with relief of pain. Shortly thereafter, patient discovered a lump at the site of application of the hot compresses. There was no history of mechanical trauma.

The general physical examination was negative except for marked obesity. In the upper and inner quadrant of the left breast, there was a hard mass the size of a hen's egg, not adherent to the skin or to the deeper structures. There was no retraction of the nipple, ecchymosis or palpable lymph-nodes.

*Operation.*—Under general anaesthesia, a simple mastectomy was carried out, removing skin and nipple with breast tissue in one piece.

*Gross Description.*—Specimen consisted of two pieces of tissue made up of interlacing fibrous septa enclosing irregular small foci of translucent, yellowish tissue, containing central areas of opaque yellowish-white necrosis. The translucent yellowish areas suggested the lobulation of a duct or gland structure, the central areas of which were necrotic.

*Microscopic Report.*—Fat necrosis.

## FAT NECROSIS OF THE BREAST

*Group 3.—Fat necrosis occurring as multiple punctate areas in a breast the seat of some other pathological process. Five cases.*

**CASE IX.**—H. A., aged thirty-seven, admitted to the Mt. Sinai Hospital, August 14, 1923, complaining of a lump in the left breast. Patient is single and has never lactated. Two months ago, patient accidentally discovered a lump in the left breast. Lump varied in size at the menstrual periods. The lump never caused pain, but there was vague discomfort in the left axilla, shoulder and back. There was no bleeding or discharge from the nipple, no history of trauma, fever or chills.

The general physical examination was negative. In the middle and upper quadrant of the left breast, there was a hard mass, irregular in outline, the size of a small egg. It was freely movable under the skin and slightly tender to palpation. There was no nipple retraction or dimpling phenomenon. A few small glands were felt in the left axilla.

*Operation.*—Under gas and ether anaesthesia several cysts of the breast, some of a bluish color, were shelled out by blunt dissection.

*Gross Description.*—Specimen consisted of a mass of tissue, measuring  $5 \times 10$  cm. This tissue was made up of many cysts which contained clear fluid. The cysts did not communicate with each other. There was also a denser portion, which on section had the

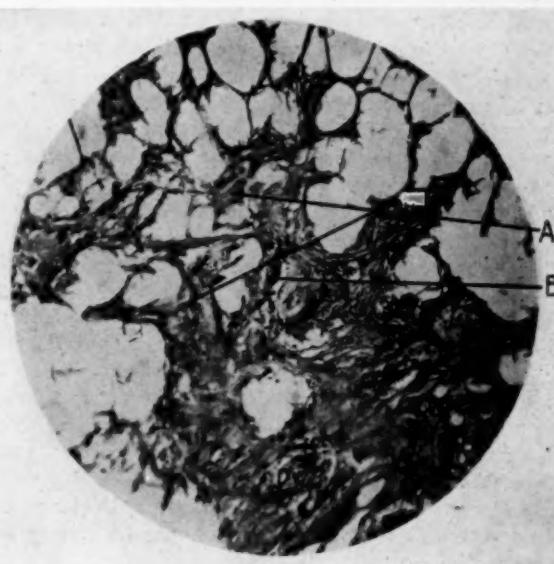


FIG. 7.—From a case in Group 4, showing, A, broken down fat. B, Giant cells.

gross appearance of normal breast tissue. *Microscopic Report.*—Sections consisted of breast tissue, the seat of marked cystic and inflammatory changes coming under the head of chronic cystic mastitis. Alongside of a widely dilated duct, the wall of which was defective in one area, there was a focus of typical fat necrosis about 3 mm. in diameter.

**CASE X.**—R. C., aged nineteen, admitted to the Mt. Sinai Hospital, complaining of a lump in the left breast. Patient is single and has never lactated. For the past three months, patient noticed a lump in the left breast which was somewhat painful and seemed to vary in size. There was no history of trauma.

The general physical examination was negative. There was a localized tumor, about  $2\frac{1}{2} \times 3$  cm. in diameter in the lower medial quadrant of the left breast. This mass was of dense consistency. There was no discoloration of the skin, retraction of the nipple or fixation to the skin or deeper tissues. There were no palpable axillary lymph-nodes.

*Operation.*—Under local anaesthesia, a mass the size of a walnut, which appeared cystic, was shelled out from the breast substance.

*Gross Description.*—Specimen consisted of breast tissue and fat about 3 cm. in diameter, showing a few cavities and yellowish-white areas in the fat.

*Microscopic Report.*—Sections show breast tissue, the seat of marked cystic disease. In close relationship with cystic spaces and dilated ducts were several areas of typical fat necrosis, each about 2 or 3 mm. in diameter.

## GOTTESMAN AND ZEMANSKY

CASE XI.—G. C., aged thirty-six, admitted to Mt. Sinai Hospital, April 10, 1926, complaining of a lump in the left breast. Patient is married and has two children living and well. She was in Mt. Sinai Hospital five years ago for diabetes of a severe grade. Her diabetes is now under control. Three weeks ago, patient noticed a mass in the left breast. Since noticing the mass, patient felt weak and had a painful sticking sensation in the breast.

The general physical examination was negative except for poor nutrition. In the left breast, which was small and atrophic, there was a firm, irregular, bilobed mass, freely movable on the skin and deeper tissues. There was a smaller lobe just beneath a lactiferous duct and firmly attached to it. The mass was not tender. There was one small hard lymph-node in the left axilla.

*Operation.*—Under local anaesthesia, the tumor in the breast was excised.

*Gross Description.*—Specimen consisted of a mass of breast tissue showing numerous small cysts, the contents of which were a yellowish semi-solid substance.

*Microscopic Report.*—Sections showed breast tissue the seat of a marked inflammatory and cystic disease. There were two areas, each about 2 mm. in diameter, of typical fat necrosis, one of which contained a fresh fatty acid crystal deposit. The other area was situated alongside of a dilated duct with defective walls.

CASE XII.—B. A., aged forty-eight, admitted to Mt. Sinai Hospital, October 31, 1923, complaining of a lump in the right breast. Patient had not lactated for seventeen years. She has had diabetes for two years. Five days ago, patient suddenly experienced pain in the right breast, and on manipulation discovered a lump there. There was no history of trauma, infection or discharge from the nipple.

The general physical examination was negative. The nipple of the right breast was retracted, and to the inner side of it there was a lump the size of a lemon. This mass was hard, attached to the skin but not to the underlying tissues. It was slightly tender, but neither red nor hot. There were no axillary nodes to be felt, but there was some induration in the right axilla.

*Operation.*—Under gas and ether, a local excision of that portion of the breast apparently affected was carried out. As the mass was excised, inspissated material was expressed from the dilated ducts.

*Gross Description.*—Specimen consisted of several masses of breast tissue which felt hard, and on section showed dilated ducts. The tissue had the appearance of mastitis without any evidence of malignancy.

*Microscopic Report.*—Sections showed breast and fatty tissue the seat of marked chronic purulent processes. There were dilated ducts with defective walls surrounded by hyaline connective tissue and phagocytic cells filled with fat. One area about 5 mm. in diameter showed typical fat necrosis.

CASE XIII.—S. B., aged forty-five, was admitted to Mt. Sinai Hospital in 1913, complaining of a red, swollen and hot right breast. Patient was married and had eleven children. For the past two months the right breast had been swollen, red and hot, and was constantly painful. Three weeks ago the process ruptured spontaneously, and discharged in three places. There was no history of trauma.

The general physical examination was negative. The right breast was reddened, swollen and tender. The induration extended 4 cm. to either side of the nipple and deep into the breast tissue. The entire breast was tender. There were three sinuses discharging pus.

*Operation.*—Under ether anaesthesia the sinuses were incised and several abscesses opened into and drained. A hard mass was found in the centre of the breast, which simulated a neoplasm. A portion of this was removed.

*Microscopic Report.*—Sections showed fat and fibrous tissue, no breast elements being identified. The tissue was the seat of a marked infiltration with round cells and polymorphonuclear leucocytes and large numbers of phagocytes filled with fat. There were several areas of typical fat necrosis, with giant cells and newly formed fat cells.

## FAT NECROSIS OF THE BREAST

TABLE I

Case	Age	Duration	Trauma	Pain	Obesity	Pathological description					
						Skin discoloration	Tumor hardness	Nipple retraction	Skin fixation	Deep attachment	Axillary nodes
Group I	1. A.G.	52	1 wk.	?	0	0	+	0	0	+	0
	2. E.S.	42	3 wks.	Surgical	+	0	+	+	+	+	0
	3. D.F.			+ +		+	0	+			
	4. E.N.	54	1 mo.	0	0	+	Transient	+	0		
Group II	5. R.K.	60	3 wks.	?	0	+	+	+	0	+	
	6. R.P.	60	?	0	0	0	+	0	0	+	
	7. D.B.	56	6 mos.	+	0	+	+	0	0	0	
	8. X.Y.	46	2 wks.	?	0	+	0	+	0	0	
Group III	9. H.A.	37	2 mos.	0	0	+	0	0	+		
	10. R.C.	19	3 mos.	0	+	0	0	0	0		
	11. G.C.	36	3 wks.		+	0	+	0	0	+	
	12. B.A.	48	5 days	0	+	0	+	+	0	0	
Group IV	13. S.B.	45	2 mos.	0	+	+	+	+	+		
	14. H.L.	39	2 mos.	0	+	0	0	0	+	0	

## GOTTESMAN AND ZEMANSKY

### *Group 4.—Fat necrosis occurring in a lipoma of the breast.*

CASE XIV.—H. L., aged thirty-nine, admitted to Mt. Sinai Hospital, April 3, 1923, complaining of a lump in the right breast. Patient has been married nineteen years, and has had three children. Fourteen months ago patient experienced a sticking pain in the right breast which grew progressively worse until it involved both breasts. Two months ago patient noticed a small tender lump in the outer part of the right breast. This mass has not increased in size. The skin over it was not ulcerated or reddened.

The general physical examination was negative except for marked obesity. At the junction of the upper and lower right quadrants of the right breast was a lump the size of an egg. It was deeply situated in the breast and fluctuated. There were no axillary nodes palpable. There was no discoloration of the skin or retraction of the nipple. The left breast was swollen, but showed no localized masses.

*Operation.*—Through a Warren incision, a fatty tumor the size of a hen's egg was shelled out from the breast tissue.

*Gross Description.*—Specimen consisted of a tumor mass measuring 7 x 4 cm., which on section was a typical lipoma covered by a very thin fibrous capsule. This mass contained one small necrotic focus about 1 cm. in diameter.

*Microscopic Report.*—Section consisted for the most part of normal fat tissue. The necrotic areas showed typical fat necrosis.

In examining the private records of the late Dr. F. S. Mandlebaum, six cases reported as fat necrosis were found. The clinical histories of these cases were not available. Examination of the slides showed that they could be classified according to our grouping.

### GROUP 1

CASE XV.—M. Sections contain skin, subcutaneous fibrous and fatty tissue, with nerve fibres and sweat glands. Fat and fibrous tissue is densely infiltrated with lymphocytes and phagocytic cells filled with fat. Several punctate areas of fat necrosis were present with marked fibrous invasion of the fat.

CASE XVI.—D. Sections consist of fat tissue showing fat necrosis in an early stage, and without any breast elements.

CASE XVII.—B. Sections consist of fat tissue, without breast elements, the seat of typical fat necrosis in an advanced stage with marked fibrosis and phagocytosis of fat droplets within giant cells.

### GROUP 2

CASE XVIII.—E. Sections include pieces of breast tissue showing pericanicular fibro-adenoma and three pieces of fat showing a late stage of fat necrosis, one piece having a small shred of breast tissue at its margin, somewhat fibrotic and infiltrated with lymphocytes.

### GROUP 3

CASE XIX.—Sections consist of breast tissue, the seat of marked cystic disease and diffuse purulent inflammation. Many areas of fat crystal deposit are present, surrounded by giant cells; several of these areas are in close relation to dilated ducts.

CASE XX.—K. Sections consist of breast tissue, the seat of a chronic inflammatory process with dilated ducts. There are two nodules, each about 5 mm. in diameter, of fatty tissue, containing polymorphonuclear cells, giant cells, phagocytic cells filled with fat and newly formed fat cells.

## FAT NECROSIS OF THE BREAST

In correlating the pathological with the clinical picture in these cases, it is interesting to note, that the only case with a positive history of trauma and the three cases in which trauma was a questionable factor occurred in Groups 1 and 2. In the cases of these groups, fat necrosis was the sole pathological lesion, either overlying or within an otherwise normal breast. It is probable that the study of cases of this type by previous observers, led them to call this lesion "traumatic" fat necrosis, since there was no other available explanation for its presence.

It was a study of the cases of Group 3 which suggested to us the possibility of other etiological agents. In this group the fat necrosis occurred as minute foci in breasts the seat of some other pathological change, either inflammatory or cystic. In none of these cases can trauma be seriously considered as a causative factor, since in none of them could any history of injury to that breast be obtained. The most constant pathological finding was the intimate relationship of minute areas of fat necrosis, 2 to 5 mm. in diameter, and dilated ducts or cystic spaces filled with fatty debris. This occurred in six out of the seven cases of this group and was accompanied by desquamation of the epithelium of that duct, loss of continuity of its wall, and periductal inflammatory changes shading off into the fat necrosis close by. It is probable that the escape of fatty material from one of these ducts or cystic spaces and its subsequent decomposition may form the irritant which causes the necrosis of the adjacent fat.

We feel, therefore, that the term traumatic fat necrosis is inadequate to explain all the manifestations of this process.

### CONCLUSIONS

1. Fat necrosis of the breast is evidence of the response of fatty tissue to an irritant.
2. Factors other than trauma may explain this phenomenon.
3. In our series, trauma as the etiological agent was an infrequent and often questionable factor in the production of this lesion.
4. Fat necrosis frequently occurs in association with diffuse inflammatory or cystic disease of the breast.
5. It is highly suggestive that the escape of fatty material from a dilated duct and its subsequent decomposition plays a rôle in the causation of this process.

We wish to thank Drs. A. A. Berg, E. Beer, C. A. Elsberg, A. V. Moschcowitz and H. Neuhof, on whose services these cases occurred, for allowing us to publish them, and Drs. P. W. Aschner, S. H. Geist, L. Cross, and P. Klemperer for kindly reviewing the microscopic slides.

### BIBLIOGRAPHY

<sup>1</sup>Lee, B. J., and Adair, F.: *ANNALS OF SURGERY*, 1920, vol. Ixxii, No. 2, p. 189.  
<sup>2</sup>Lee, B. J., and Adair, F.: *ANNALS OF SURGERY*, November, 1924, vol. lxxx, No. 5, p. 670.  
<sup>3</sup>Farr, C. E.: *ANNALS OF SURGERY*, 1923, vol. Ixxvii, No. 5, p. 513.

## VALUE OF X-RAY IN DIAGNOSIS OF PERFORATED DUODENAL ULCER

BY GEORGE F. COTTLE, M.D.

COMMANDER, MEDICAL CORPS, U. S. NAVY

AND

OTIS B. SPALDING, M.D.

LIEUTENANT, MEDICAL CORPS, U. S. NAVY

THE United States Fleet consists of ships afloat on the high seas. Essentially a mobile organization it cruises each year long distances and for weeks at a time far from shore bases and many days sea travel from ports where hospitals are to be found. To meet the peace time medical and surgical needs of the personnel of these ships, well equipped sick bays manned by Naval Surgeons and their assistants exist on each of the larger ships. The Naval Surgeons attached to these ships know that they must keep themselves prepared to meet medical and surgical emergencies and not infrequently that they must meet them alone. They cannot always send their hospital cases to a hospital. The Navy Department however recognizes the need for group medical practice in the Fleet and for the equipment that can only be supplied by a hospital and so, attached to each major geographical division of the Fleet is a hospital ship, the *Relief* for the west coast group and the *Mercy* for the east coast group. Each of these ships carries a well balanced group of doctors organized for group medical and surgical practice and each has a medical equipment and personnel recognized by the American College of Surgeons as being up to its standard requirements for Class A hospitals. Whenever possible, patients in need of hospital care are transferred for treatment to these hospital ships.

Among the surgical emergencies normally considered in need of hospital care, one which strikes with almost lightning speed requiring early diagnosis and prompt surgical relief is the perforated ulcer of stomach or duodenum. During the twelve-month period ending October 31, 1926, it so happened that there occurred among the personnel of the battleship divisions of the Pacific Fleet eight cases of ruptured ulcer of the duodenum. One of these developed on a ship at the time distant from the hospital ship and was operated upon by the ship's medical officer and the other seven cases were received aboard the hospital ship *Relief* and operated upon by the surgical staff of that vessel. Some of these came while the vessels of the Fleet were at anchor in port, others while the vessels were at sea. In two cases it was necessary for the ships to drop out of line during manœuvres to transfer these acutely ill persons from a ship busy at target practice to the more quiet environment of the hospital ship. That all eight of these cases were recognized on ships at sea and prepared for operation within ten hours of onset of symptoms is an index of the alert attitude of the Naval Surgeon

## X-RAY IN PERFORATED DUODENAL ULCER

toward surgical emergencies and demonstrates that early diagnosis, rapid transportation for the sick and prompt surgical relief are as much a factor of Navy life today as they are in civilian communities ashore.

The total average personnel of the battleship divisions of the Pacific Fleet is approximately 10,000 and it is perhaps a little unusual that eight cases of perforated or ruptured duodenal ulcer should have developed in a twelve-month period in a group of that number. The incidence of this rather rare catastrophe must vary considerably with different surgeons and at different hospitals. The Surgeon General's annual reports for the years 1924 and 1925 show less than eight cases for each of those years among the entire Naval personnel of over 86,000 persons. Moynihan in his abdominal operations—1926 Edition says: "At the Leed's Infirmary in the year 1923 there were 56 cases of perforated duodenal ulcer." In contrast to this is the statement of Young of Glasgow quoted from the proceedings of the Mayo Clinic for October 18, 1926: "Hardly a receiving day passes without one or more cases of perforated duodenal ulcer coming into my wards. On occasion I have received as many as half a dozen in one day." The surgical service of the *Relief* realizes that in reporting this small series of cases it can only repeat some of the well known facts about this usually rather clear cut clinical entity. The report is written to emphasize the use of a diagnostic sign obtained by X-ray which has not been heretofore frequently reported in articles dealing with this subject.

The diagnosis of a typical case, stricken suddenly by what obviously is an abdominal catastrophe is not difficult. The rigid abdomen, acute pain, tender upper right abdomen, the facies of shock, the vomiting, the rising pulse, high white count and high polymorphonuclears make a picture for the alert diagnostician familiar with this emergency which necessitates but one decision, immediate operation. Every case however is not so typical Moynihan states "The clinical picture of appendicitis is copied with such accuracy that out of 49 recorded cases tabulated by me in the *Lancet*, in 18 the first incision was made over the appendix after a diagnosis of acute appendicitis had been made." The symptoms vary with the time after onset. The shock is not always seen, it often is transitory or slight in degree, a brief period of partial remission of the symptoms not infrequently will occur. Three definite stages which merge rather rapidly one into the other are always present and the symptoms change as the underlying pathology changes. Thompson in *Surgery, Gynaecology and Obstetrics* of March, 1926, designates these: "(1) The stage of contamination, (2) reaction, (3) stage of peritonitis. In the first stage shock may be the overshadowing clinical entity. A history of antecedent chronic pathology may be at that time difficult to obtain. The patient can think only of his extreme pain, and his mind and nervous system are entirely occupied with the effort required to keep his abdomen hard, his knees drawn up and his respiratory rate restricted to lessen the agony into which the sudden contamination of his peritoneum with

## COTTLER AND SPALDING

acid gastric juices has precipitated him. In this stage and even in the late stages, other conditions as possibilities enter the mind of the observer, diaphragmatic pleuro-pneumonia, gall-stone colic, acute obstructive cholecystitis, acute pancreatitis, perforated appendix, ectopic pregnancy and incarcerated hernia. In the second stage the gradually subsiding pulse, the softening abdomen, the disappearance of shock and the patient's sense of slight improvement may tend to stay the action of the clinician and lead him to believe the storm is passing and that after all he is to have time for a

carefully considered diagnosis. In this stage of reaction we have the acid gastric juice becoming diluted by the peritoneal exudates and the flowing of this material over the hepatic flexure of the colon into the right gutter so that symptoms referable to the upper abdomen tend to disappear and are replaced by pain and tenderness over the appendix or as the pelvis fills with this material, later still pain and tender-

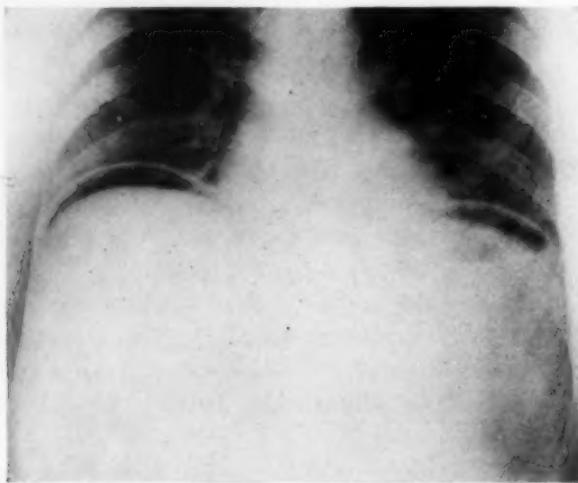


FIG. 1.—Skiagraph showing presence of gas between the diaphragm and the liver.

ness over the left lower abdomen. In the case of a ruptured hollow viscus the stage of remission is brief, soon the pulse begins again to mount, the belly to slowly distend, the pain and tenderness to become more diffused and difficult to exactly localize, the rigidity to be less localized, in fact, the picture of rapidly developing general peritonitis accompanies the entrance of the patient to the third stage peritonitis.

In but few surgical emergencies is time so vital a factor as in this one. The earlier the "blow out" in the intestinal tube is closed the better the hope for recovery. Statistics have been compiled to show that the mortality is negligible if operation is done within ten hours of the onset of symptoms and that mortality increases thereafter at a rapid rate. Thirty-six hours after onset operative mortality is very high. To diagnose an acute abdomen as ruptured duodenal ulcer, to convince the patient and perhaps his relatives of the necessity for immediate surgery, to transfer the patient to hospital and to have the hole in the gut closed all within ten hours, requires an alert clinician and good team work. When such decisions are made on a battleship at sea, when the medical officer of a ship must ask the Captain to hold up the military activities of his ship or perhaps ask him to leave the line during manœuvres, approach the hospital ship and transport such a patient to the

#### X-RAY IN PERFORATED DUODENAL ULCER

hospital ship for operation, he must be sure of his clinical findings. The captain of the ship and perhaps the admiral are going to ask later whether the need of the patient was really as acute as represented. A failure to recommend speedy action may mean death to the patient. A few hours' delay for a case of acute appendicitis which has not ruptured, not infrequently is reasonable when a ship is busy at sea, but such a delay in the presence of an acute abdominal catastrophe may prove fatal. Captains of these ships must be shown that the need is real and that speed is imperative. The time between onset and operation in the eight cases in this series was under ten hours, except in one case, in which it was twenty-two hours. These ship's medical officers were on the job. They had the courage of their convictions, their diagnoses were correct. Without such alert clinicians on our ships the record of 100 per cent. recovery in these eight cases could not have been made.

Fortunately the clinical picture is usually definite and convincing, but there are cases in which the symptoms are not so striking and conclusive. Age, concurrent pathology, a slow instead of a rapid leak of duodenal contents or other factors, may blur the picture and make the decision for immediate surgery less easy to reach. In those cases where an element of doubt enters, we have searched for some sign to help sharpen the picture. The text-books speak of the loss of liver dulness which is present in this condition when gas from the stomach or duodenum has flowed out and come to lie between the diaphragm and the liver. To wait for such a sign to appear would be wrong and might prove fatal. We have found that diminished liver dulness has been reported by one clinician and the finding denied by another in the same case. There must be a considerable amount of free gas in the peritoneum for this sign to be present. It occurred to our röntgenologist that the X-ray might help in these cases and it has been our experience that it does. An amount of gas too small to reveal its presence by percussion will show with unmistakable clearness on an X-ray plate. When found by X-ray its presence has been verified at operation by the sound of gas escaping from the peritoneum when first nicked by the surgeon's knife. This X-ray finding is not always present and its absence should not lead to a denial of the existence of perforated ulcer. It would not be right to delay operation to obtain this corroborative evidence. Whenever a patient with acute abdomen is admitted, we now take him into the X-ray room enroute to the ward or take such a patient to the X-ray room when he is enroute to the operating room. This does not delay the progress of the surgeon toward his goal of immediate surgical relief. In one of our cases the positive X-ray finding speeded up the moment of decision. This X-ray sign is especially valuable when the patient is first seen in the stage of reaction or at the very beginning of the onset of his peritonitis. It may help the surgeon to distinguish between the acute perforated appendix and the perforated ulcer and thereby shorten the search on the operating table for the cause of the difficulty. Pictures are taken with the patient on his face and with the patient on his left side. Objections

## COTTLER AND SPALDING

may be raised to this on the ground that such movements may disseminate the escaping stomach content. Perhaps it does, but we fear every moment of unnecessary delay more than we fear this theoretical danger. It is a matter of but a few moments after the taking of the plate before the röntgenologist can report a positive or a negative finding.

The conduct of the operation is simple, localization of the perforation, suture with chromic gut or silk, reinforcement with omental tags. We remove some of the green-colored, cloudy peritoneal exudate with the gauze packs used to isolate the perforation during the time of suture, but do not try to mop all of the fluid out. We do not believe that gastro-enterostomy should be done unless pyloric obstruction is present or is brought about by the necessities of the suture of the opening. We do not drain unless more than twenty-four hours have elapsed since the onset.

Recovery from the emergency of perforation is all that can be reported in this series. We do not know whether or not these patients have or are to have a recurrence of ulcer symptoms. We do know that all of them have been returned to duty in the Navy and it is believed their hope of recovery from a later operation, if necessary, will be greater at a time when the peritoneum is not laboring with the result of contamination than it would be if, as a routine, gastro-enterostomy with or without resection were practiced at the same operation as the closure of the hole in the gut.

*In Conclusion.*—Eight cases of perforated ulcer of the duodenum, diagnosed on naval vessels afloat, are reported. All but one were operated upon within ten hours of onset and all recovered. An X-ray finding in these cases is reported which is believed to be of more value when found than the usually unsuccessful search for diminished liver dulness.

### CASE REPORTS

**CASE I.**—No. 8546, M. C. F., Seaman, first class, U. S. Navy, age twenty-one years. Admitted November 2, 1925, from U.S.S. *Relief*. Diagnosed ulcer duodenum.

*Past History.*—An indefinite history of epigastric pain, present at variable and irregular intervals for a period of ten years, not a good history of ulcer.

*Present History.*—Four and one-half hours before admission to U.S.S. *Relief* he was taken suddenly with a severe cutting pain in the epigastrium. It doubled him up, an opiate did not relieve the pain. Examination showed him to be in moderate shock with the facies of pain, the entire abdomen was hard like a board. There was tenderness in the right upper quadrant. Leucocytes, 26,900; Polymorphonuclears, 94 per cent.; temperature, 100.8; pulse, 88; respiration, 28.

*Operation.*—Appendectomy and suture of perforated ulcer of first portion of duodenum was followed by rapid recovery.

*Discussion.*—No X-ray was taken in this case because it had not at this time occurred to the röntgenologist that free gas in the peritoneum might be found in these cases. (Cottle.)

**CASE II.**—No. 9001, L. L. J., Private, U.S.M.C., age twenty-one years. Admitted January 31, 1926 from U.S.S. *West Virginia* six days after operation for ruptured duodenal ulcer. Operation performed by medical officer of his own ship. Data in detail not available. Recovery. (Shepard.)

**CASE III.**—No. 9665, J. F., Seaman, second class, U. S. Navy, age nineteen years. Admitted April 10, 1926 from U.S.S. *Nevada*. Diagnosed.—Ulcer duodenum.

## X-RAY IN PERFORATED DUODENAL ULCER

*Past History.*—History of ulcer duodenum diagnosed eight months ago and then confirmed by X-ray.

*Present History.*—Five hours before admission to U.S.S. *Relief* he was taken with a sudden severe upper abdominal pain. Vomited several times.

*Examination* showed moderate shock, a board-like abdominal rigidity most marked upper right quadrant where there was also extreme tenderness. Leucocytes, 24,450; polymorphonuclears, 85 per cent; temperature, 98; pulse, 98; respiration, 18. X-ray positive for air between liver and diaphragm.

*Operation* disclosed ulcer perforated in same site formerly diagnosed by X-ray. Rapid recovery. (Cottle.)

CASE IV.—No. 10,675, P. J., Seaman, second class, U. S. Navy, age twenty-one years. Admitted April 16, 1926 from U.S.S. *New Mexico*. Diagnosed.—Appendicitis acute.

*Past History.*—Negative. No indigestion.

*Present History.*—Two days before admission to U.S.S. *Relief* he had a severe pain in the upper abdomen and vomited once. The day following this abdomen was tender and pain continued but seemed difficult to localize. Examination showed abdomen to be slightly distended and there was generalized abdominal tenderness and rigidity. Rectal examination showed more tenderness to the right than to the left. Leucocytes, 22,400; polymorphonuclears, 90 per cent.; temperature, 100, pulse, 98; respiration 20. Pre-operative diagnosis was made. Ruptured appendix versus ruptured duodenal ulcer.

*Discussion.*—Unfortunately in this case an X-ray to show presence or absence of air in the peritoneum was not done though it might have proven the diagnosis instead of leaving it in doubt. Here operation disclosed a normal appendix bathed in sero-pus. After appendectomy the right rectus incision was extended upward and the perforated duodenal ulcer sutured in the usual manner. From this history it is impossible to state how much time elapsed after the actual perforation occurred before operation was performed but it was probably not the full period given in the history, i.e., nearly forty-eight hours. It is in just this type of case that the X-ray showing free air in the peritoneum may at times be of great value. (Boone.)

CASE V.—No. 10,788, B. A. S., Torpedoman, first class, U. S. Navy, age twenty-eight years. Admitted August 14, 1926 from U.S.S. *Percival*. Diagnosed.—Appendicitis, acute.

*Past History.*—Negative except for attack of acute indigestion ten years ago and again six weeks ago a three-hour attack of generalized abdominal pain, since which time there has been bloating and an indefinite epigastric pain most felt at night.

*Present History.*—Four hours before admission to U.S.S. *Relief* he was taken while at work on his ship with pain in upper abdomen. It did not double him up and for an hour he continued at work. There was no vomiting at any time. Examination showed tenderness over McBurney's point and rigidity of right abdomen and hypochondrium. Leucocytes, 16,750; polymorphonuclears, 78 per cent.; temperature, 99.2; pulse, 90; respiration, 18.

*Operation.*—Through a McBurney incision local anaesthesia permitted the removal of a normal appendix bathed in a greenish-yellow, cloudy peritoneal exudate. A second incision high right rectus disclosed the pathology one-eighth inch hole in the first portion of the duodenum close to the pyloric ring.

*Discussion.*—The absence of shock and the low pulse and leucocyte counts led all away from the history of antecedent stomach trouble. In this case an ante-operative X-ray, which unfortunately was not taken, might have made possible a direct attack upon the pathology without the appendectomy which was unnecessary to effect a cure. (Cottle.)

CASE VI.—No. 11,373, B. B. C., Fireman, second class, U. S. Navy, age twenty-four years. Admitted October 22, 1926, from U.S.S. *Arizona*. Diagnosed.—Ulcer duodenum.

*Past History.*—A typical ulcer story of two years' duration.

## COTTE AND SPALDING

*Present History.*—At 7 A.M. he went on watch but at 7.30 A.M. a severe pain in the abdomen doubled him up and as he said "dropped him." Two and one-quarter grains of morphine did not seem to have any beneficial effect. At 10 A.M. two and one-half hours after onset he was admitted to the U.S.S. *Relief* suffering intense right upper abdominal pain. The abdomen was hard as a board and extremely tender, most marked on the right side. Leucocytes, 11,500; polymorphonuclears, 88 per cent.; temperature, 100; pulse, 110, respiration, 24. On the way to the operating room an X-ray plate was taken which showed "air beneath right diaphragm also air about the right kidney and duodenal area."

*Discussion.*—In this case the X-ray though corroborative was not needed to make the diagnosis which operation corroborated. Suture of the "blow out" began a rapid recovery. (Joldersma.)

CASE VII.—No. 11,412, L. W. L., Lieutenant-Commander, U. S. Navy, age thirty-nine years. Admitted October 27, 1926. Diagnosis undetermined (gall-stones); from U.S.S. *Arizona*.

*Past History.*—Fair for ulcer or gall-stone colic extending back for one and one-half years. Barium series and other tests made about one year ago failed to reveal presence of an ulcer and diet directed at control of cholecystitis resulted in a definite remission of symptoms till about ten days ago when stomach distress, belching and sour eructations reappeared after what he considered a mild indiscretion in diet.

*Present History.*—At 11 A.M. five hours before admission to the U.S.S. *Relief* he was taken with a severe pain in the right epigastrium which radiated to the right shoulder. He was nauseated and the pain caused him to sweat. Examination showed him to be in moderate shock, abdomen rigid, most marked on right side, but almost board-like all over. Tenderness was definitely located over the gall-bladder. Leucocytes, 20,250; polymorphonuclears, 92 per cent., temperature, 99.8, pulse, 104; respiration, 24. After a severe attack of vomiting (5 times) coffee ground material which in the laboratory was said to be altered blood, he entered the stage of remission and felt so much better that he refused operation in spite of the fact that he was told that he had a perforated ulcer and that delay too long would mean death. An X-ray plate taken in the hope that it might convince him of the need for operation was negative for free gas in the peritoneum. The twenty-second hour after onset he consented to operation and though contamination was extensive and even the pelvis overflowing with the green yellow cloudy peritoneal exudate he fortunately recovered. This case was drained for forty-eight hours because of the time which had elapsed after perforation had occurred. (Cottle.)

CASE VIII.—No. 11, 492, B. J. T., Aviation Chief Machinist's Mate, U. S. Navy, age twenty-nine years. Admitted October 16, 1926, from U.S.S. *Colorado*. Diagnosis undetermined (acute abdomen).

*Past History.*—A good ulcer history duration two years.

*Present History.*—About four and one-half hours before admission to the U.S.S. *Relief* while at work on deck he was suddenly taken with a sharp knife-like stabbing pain in right upper abdomen. He had to lie down. He became nauseated, broke out in a cold sweat and was taken by his shipmates to the sick bay. Examination showed a board-like abdomen with acute tenderness in the epigastrium. Temperature, 100.8; pulse, 88; respiration, 28. Leucocytes, 13,250; polymorphonuclears, 85 per cent.; X-ray showed "air between the diaphragm and liver."

*Discussion.*—The X-ray corroborated the diagnosis tentatively made on the clinical picture. Gas escaped from the peritoneum when nicked and the ulcer was infolded as in the other cases of this series. (Cottle.)

# TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY

*Stated Meeting Held October 27, 1926*

The President, DR. WALTON MARTIN, in the Chair

## MELANOMA OF THE LOWER EXTREMITY

DR. NATHAN W. GREEN presented an adult woman, who was admitted to St. Luke's Hospital, July 6, 1920, on account of a growth on the inner side of the left foot. One year ago she injured a mole which she had had all her life. Six months later the growth began to increase in size and it began to pain three weeks before admission. Physical examination revealed a small dark-colored growth on the inner side of her left foot.

July 7, 1920, Dr. Nathan W. Green, under gas and ether anaesthesia, made a wide excision, lifting up the edge of the skin with forceps and cutting the trabeculae of areolar tissue with a sharp knife, not at any time touching nor pinching nor pressing the growth. A Thiersch skin grafting was done immediately.

*Pathological Report.*—From the Laboratory of Dr. Francis Carter Wood. The specimen consisted of a flat piece of tissue from the heel, measuring 8 x 6 cm. and about 1.5 cm. thick. In the centre was a blackish area from which the epithelium was largely denuded. On section this showed a thin but continuous layer of tumor tissue which penetrated the fat only to a slight degree. The deep surface being apparently normal. The tumor tissue was fairly firm and very deeply pigmented.

On microscopical examination the sections from the tumor taken from various portions showed a rather extensive growth involving chiefly the subcutaneous tissue. This spread widely through it, forming a rather narrow and diffuse band of tumor tissue in the upper portion of the excised area. The growth itself seemed to consist of spindle-shaped cells with a tendency to grow in rather loose alveoli or to infiltrate the fibrous tissue. It extended well up into the epithelial layers, even displacing the basal cells. Many of these tumor cells were deeply pigmented with a golden brown or greenish intracellular granular pigment. The deep border in all the sections appeared normal.

The patient was discharged on August 6, 1920. To-day, October 27, 1926, six years after her operation, she appears clinically free of malignancy.

DOCTOR GREEN added further that he had a personal communication from Dr. Robert T. Morris stating that he had had a similar experience wherein the patient went over six years after removal without apparent malignancy and finally developed metastases of the liver. He had referred this case to Doctor Coley. Doctor Green said that he made a wide incision at a good distance from the pigmented area and lifted up the skin edge and put the trabeculae of areolar tissue on the stretch and cut this as near the deep fascia as possible with a sharp knife. In this way it was less disturbing to the growth and there was less danger of dislodging tumor cells into the circulation.

NEW YORK SURGICAL SOCIETY

LONG-STANDING RECOVERY FROM PYLORIC OBSTRUCTION SIMULATING CANCER AFTER A PALLIATIVE GASTRO-ENTEROSTOMY

DR. NATHAN W. GREEN presented a man, fifty-six years of age, who was admitted to the Memorial Hospital, February 6, 1922. His present illness dates from November, 1921, since which time he lost about thirty pounds in weight. At that time a dull pressing pain was felt about the epigastrium about one and one-half to two hours after eating, which was somewhat relieved by vomiting. Pain and vomiting persisted after each meal until about one month ago, when a steady dull pain was felt in the epigastric region, radiating to the back and sides. He was unable to retain food, and had kept on fluids up to the time of admission.



FIG. 1.—Taken December, 1923, shows what appeared to be a filling defect and some delay at emptying by the stoma.

gastrum. A diagnosis of carcinoma of the stomach was made and the patient was referred to the Conference. He was recommended for admission by the Conference for a gastro-enterostomy, which was done by Doctor Green, February 10, 1922, under 1 per cent. novocaine.

The pathologic findings revealed an indurated mass which was attached to the posterior abdominal wall. There was no invasion noted of the anterior surface of the prepyloric area. The tendency was to bend the stomach backward in the region of the pylorus. This backward bending of the stomach and adherence of the pylorus evidently was causing the obstruction. A posterior gastro-jejunostomy was quickly done and on account of the weakness of the patient no specimen was taken for biopsy. He made a steady recovery and, May 25, 1922, he was released from the Social Service and went to the Catskills.

December 14, 1923, a note made by Doctor Herendeen stated that X-ray examination revealed the presence of a large annular carcinoma of the prepyloric segment. The gastro-enterostomy stoma seemed involved as there was considerable retention at six hours. The picture of this condition is attached herewith. (Fig. 1.)

March 1, 1926, he complained of burning and did not look well.

February 2, 1926, a note from Doctor Herendeen's laboratory stated that the annular deformity of the antrum was clearly shown and the larger part

## LONG-STANDING RECOVERY FROM PYLORIC OBSTRUCTION

of the stomach appeared normal, and that barium was leaving through the enterostomy opening, and at six hours practically none was left.

In the fall of 1926 the patient was improved and had a good appetite. An X-ray taken at this time is shown for comparison in Fig. 2. His weight in October, 1926, was 102½ pounds, whereas on December 12, 1923, when X-ray No. 1 was taken, it was 123½ pounds. He has worked ever since the spring of 1922 with occasional days off.

The patient was shown as a case in which a diagnosis of carcinoma of the stomach was reasonable and this was corroborated by the X-ray. But in view of the later course of the case the question of diagnosis has been placed in doubt and very properly. Also it shows that although a patient may present the picture of an advanced and inoperable carcinoma, it is justifiable to give him the benefit of the doubt, and do in selected cases a palliative operation. This man has gone nearly five years since his gastro-enterostomy.

DR. GEORGE WOOLSEY remarked that he did not see how a positive diagnosis could be made simply from the X-ray and the history. Where a tumor mass showed in the X-ray in this situation, he had been unable in a few cases, even when the mass is exposed, to make a diagnosis. A good many years ago he explored a stomach case, making a diagnosis of carcinoma and doing a gastro-enterostomy. Two years later he saw the man. He had gained forty pounds in weight. Twelve or thirteen years later he heard of him in perfect health. He did not think one could make a positive diagnosis from the X-ray alone, in early cases.

DR. RICHARD LEWISOHN agreed that at the time of operation an ulcer was present near the pylorus. It is very difficult to say whether it had transformed into a carcinoma in the interval. He suggested that the patient should be operated again, as he may still suffer from an old ulcer which should be removed in order to prevent subsequent malignant degeneration. If malignancy had been superimposed on the old ulcer, an attempt at radical removal of the carcinoma should be made.

DOCTOR GREEN rejoined that he did not think anyone should be content to make a diagnosis by X-ray alone, as it was merely a shadow, although in the majority of cases the X-ray gave very good corroborative evidence taken together with other factors. In this case, the patient had got along so well that he was in doubt whether his original diagnosis was right. The



FIG. 2.—Taken in the fall of 1926, still shows what appeared to be a filling defect, much the same as in Fig. 1. The diagnosis of carcinoma is by this placed in doubt.

## NEW YORK SURGICAL SOCIETY

patient was presented as an illustration of what may eventuate when a palliative gastro-enterostomy has been done for what appeared to be a case, moribund from gastric cancer. He would be unwilling to resect the stomach in this frail old gentleman. He thought he had already had a pretty fair lease of life. Comparison of the two gastric pictures two and a half years apart showed but slight change in the contour.

### EPITHELIOMA OF THE PENIS

DR. NATHAN W. GREEN presented a man, about fifty-four years of age, who was admitted to St. Luke's Hospital, July 15, 1924. About six months previous to admission he noticed itching of the head of the penis. He treated it with some salve and was relieved. About three months previous to his admission he felt a little hard area like a white wart. June 28 he noticed intense stinging in the penis which prevented him from sleeping. On examination a red mass was found about the size of a medium-sized pea, in addition to the "white wart." The reddish area bled a little at times. His previous history and family history was irrelevant.

On examination there were found two small growths on the dorsum of the penis near the glans. Each was about the size of a dime; one appeared papillomatous and the other like a strawberry. The inguinal nodes were not enlarged. There was slight induration around the growths. The Wassermann was negative.

July 18, 1924, Dr. Nathan W. Green circumcised the man and excised the growths.

July 18, 1924, a diagnosis of epithelioma was made by Doctor Knox, after microscopical examination. The sections of the specimen showed it to be a very extensive type of epithelial growth which is now infiltrating and morphologically malignant. There were many large solid masses of epithelial cells in which differentiation was fairly complete, but the basal layers appeared to be very much more actively growing. It contained many mitoses, and the basement membrane was not intact. The growth was, however, fairly superficial, but was extremely vascular. There were many pearls throughout.

July 29, 1924, dissection of the left inguinal nodes was done. This specimen showed chronic adenitis (inguinal) but no metastases.

August 8, 1924, dissection of the right inguinal and femoral glands was done. This specimen showed chronic adenitis (femoral and inguinal), no tumor cells were found.

Between September 29, 1924, and March 3, 1925, the patient was submitted to nine X-ray séances in Dr. Francis C. Wood's Department. Raying the right or left inguinal region alternatively for from fifteen to twenty minutes with a rather low voltage tube and filtered through aluminum.

The patient was readmitted, March 23, 1925, with what was feared to be a local recurrence. The remaining foreskin did not retract over the corona. On the anterior surface of the penis, just behind the glans, there was a slightly thickened, indurated area. Apparently extending into the corpus cavernosum. The foreskin was redundant and somewhat adherent to the glans.

March 26, 1925, by a circular incision, the thickened area was excised, extending deeply into the corpus cavernosum and glans almost to the wall of the urethra, but this specimen showed only chronic balanitis.

Microscopical examination made by Dr. L. C. Knox reported that the sections showed skin, together with subcutaneous tissue and small, dilated, thick-walled vessels. There was a chronic inflammation of the skin itself with

## ENTAMŒBIC ABSCESS OF TRANSVERSE COLON

extensive infiltration in the epithelial layer and beneath it. Polymorpho-nuclear cells, plasma cells and round cells were also present. This infiltration extended inward along the vessels and the nerves. The epithelium showed very light hypertrophy in some areas, but there was no evidence of malignancy. (That is, there was no recurrence.)

From August 11, 1925, to October 19, 1926, the patient has again been subjected to radiotherapy, having been given nine treatments alternating on either side. He now appears free from malignancy and is in good nutrition, attending to his work every day. He was presented to illustrate a procedure where the organs had been spared and where the devastating operation of total ablation had not been done and so far, well over two years, there had been no recurrence of malignancy.

## ENTAMŒBIC ABSCESS OF TRANSVERSE COLON

DR. EUGENE H. POOL presented a man, twenty-nine years of age, who was admitted in October, 1925, to the New York Hospital. He had been in hospital two years before with a diagnosis of chronic colitis. Proctoscopic examination at that time showed several bleeding ulcers. Barium enema was negative. After leaving hospital he was quite well, except for intermittent diarrhoea. Fifteen days before recent admission he noticed tenderness to the left of the umbilicus. This tenderness increased but he had no actual pain. He had no bloody stools and had not lost weight. Patient is a sailor and has been to South America and Africa.

*Physical Examination.*—A fairly well-developed, rather poorly nourished man, appearing chronically ill. Examination of abdomen showed definite spasm of muscles in region of umbilicus, where a mass was palpable to the left of the umbilicus. Surface was slightly irregular, firm and quite tender. Urine negative, white blood-cells 21,000, polymorphonuclears 58 per cent., lymphocytes 19, transitinals 11, eosinophiles 12 per cent., stools—red blood-cells.

*X-ray.*—Enema showed no obstruction but marked kinking and spasm in transverse colon.

Patient was explored November 2, 1925, and a first-stage Mikulicz operation performed. A mass involving the transverse colon was found. The mass was about five inches in diameter and to it was attached the omentum. On the under surface were adherent two loops of small intestine. The lymph-nodes were generally enlarged, even on the greater curvature. The whole mass could be lifted out of the abdomen, and it seemed wise to do a first-stage Mikulicz as no nodules were felt in the liver. A lymph-node was removed for microscopic examination. The two loops of small intestine were freed, and the whole mass then lifted out of the abdomen, and the cæcum sutured to the distal part of the transverse colon. The first day post-operative patient was given a transfusion of 500 c.c. of blood.

On the second day a tube was introduced and sutured. Seven days later the specimen was removed after clamping the intestine and cutting between clamps, and ligating the meso-colon. The specimen removed showed a large intestine with mucous surface covered with small projections about 2 cm. in diameter, suggesting small polypi. There was a dense ring 1.5 cm. in diameter where the intestine had perforated, communicating with an abscess cavity containing pus and necrotic tissue. Three days later, redundant intestine was excised with knife and cautery. Into the proximal limb a suction tip was inserted and maintained with one silk suture. Four days later patient was given another blood transfusion of 500 c.c.

*Pathological Report.*—1. Node shows an enormous increase in the number of lymph follicles with dilated lymph channels.

## NEW YORK SURGICAL SOCIETY

2. Large mass 23 by 20 cm. Microscopic examination shows the lesions of amebic colitis. Amœbae found in the pus.

3. Three specimens of bile in Bouin's fluid obtained by duodenal tube and stimulation by 50 per cent. magnesium sulphate solution. Section of hardened sediment in paraffin shows many pus cells with detritus and occasional epithelial cells. A few cells suspicious of encysted amœbae (dysentery) were found after careful search.

4. Three specimens of bile in Bouin's fluid obtained by duodenal tube and stimulation by 5 per cent. sodium taurocholate solution. Section of hardened centrifuged sediment of three bile specimens show occasional pus and epithelial cells, but no entamoebæ dysentericae. (January 12.)

Soon after the second-stage Mikulicz treatment was begun. It consisted in subcutaneous injections of emetine hydrochloride, later stovarsol and b.i.d. irrigations of silver nitrate solution (1/1500 to 1/1000). February 15 (105 days after original operation), the colostomy wound was closed. An appendectomy was done and a No. 20 French catheter was inserted in the appendix stump. Fistula healed without leakage and in eight days cœcostomy tube was removed.

*Follow-up Report.*—June 6, 1926. Patient returned to work one month after discharge and continued at work every day since. Bowel's regular. Appetite good. Has gained ten pounds. No diarrhea. No pain. Feels well. Physical examination: Condition excellent, small hernia at upper end of his incision.

### CLOSURE OF ABSCESS OF LUNG BY MUSCLE TRANSPLANT

DR. EUGENE H. POOL presented a man, aged twenty-six years, who was first admitted to the medical ward of the New York Hospital in August,

1911, with a diagnosis of incipient tuberculosis. He had physical signs on the left apex but sputum was negative. His tonsils were removed soon after this. His second admission was in January, 1926, with a diagnosis of lung abscess. He was operated upon February 4 by incision and drainage of the abscess. Under local anaesthesia two inches of two ribs were removed high in the right axilla. The abscess was opened and considerable thick pus evacuated. Two rubber tubes were

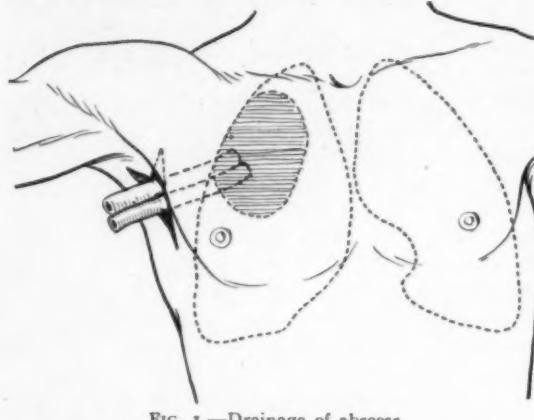


FIG. 1.—Drainage of abscess.

introduced. (Fig. 1.) His convalescence was good. His sputum was negative for tuberculosis. He was again admitted April 1, 1926, with a persistent sinus. X-ray after lipiodol injection into the sinus showed communication with a bronchus. (Fig. 2.)

*Laboratory Reports.*—February 9, 1926. Specimen, at time draining from abscess, consists of mass of necrotic tissue. Microscopic examination reveals a mass resembling mycelia with clear spore-like bodies. Occasionally branched forms appear. These masses resemble some form of higher bacteria, possibly *Aspergillus nodularis*. April 22, 1926, Autopsy of guinea pig

## CLOSURE OF ABSCESS OF LUNG BY MUSCLE TRANSPLANT

injected with 2 c.c. of pus from lung abscess. February 11, 1926, showed no lesions. February 20, 1926, cultures from the wound exudate show staphylo-

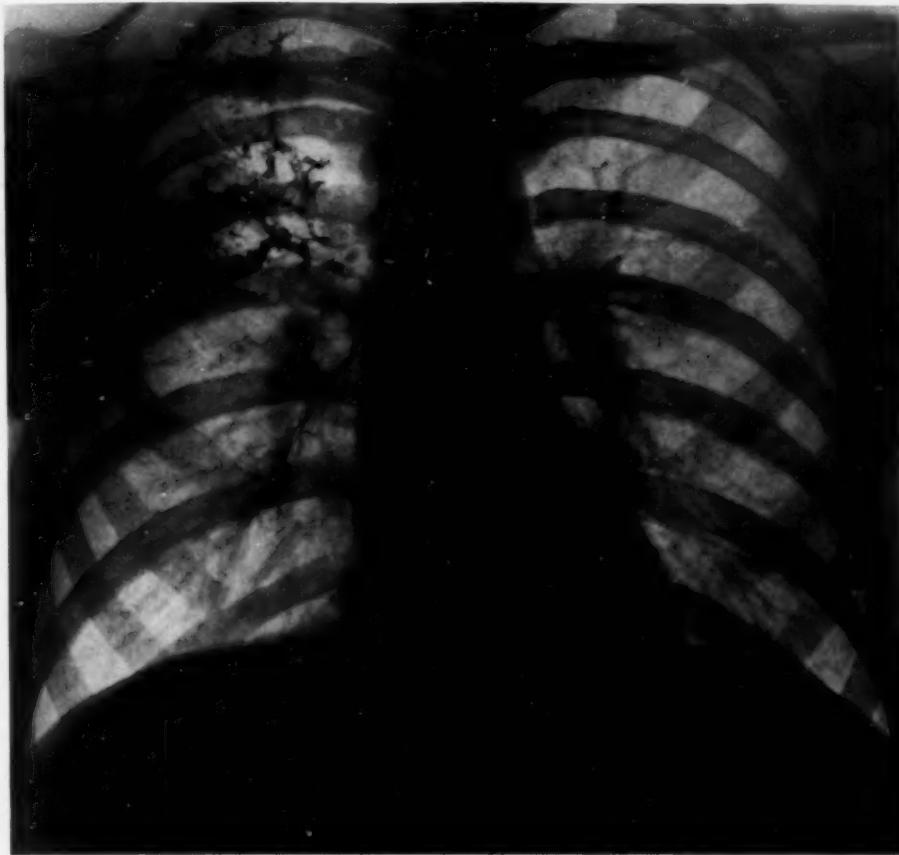


FIG. 2.—Result of lipiodol injection into chest sinus.

coccus aureus as the predominating organism with a few colonies of non-haemolytic streptococcus. No higher bacteria, pathogenic yeasts or molds.

Sputum examination—January 20, 21, and 22, 1926, negative for tuberculosis.

May 3, 1926, operation for closure of bronchial fistula. Skin around the sinus excised. New-formed bone around the opening into the thorax excised. The cavity was about the length of the index finger. Its walls were soft and friable and the cavity was about 2 cm. in diameter. The incision was extended along the lower

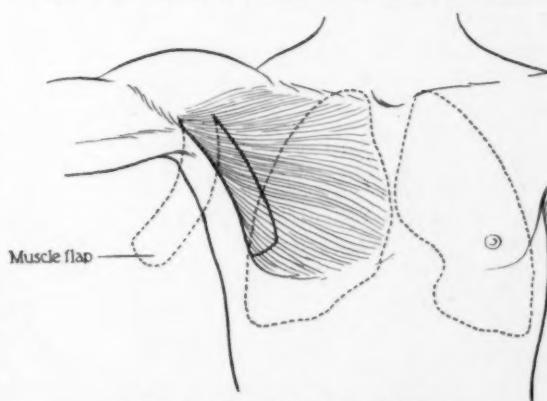


FIG. 3.—Formation of muscle flap.

## NEW YORK SURGICAL SOCIETY

margin of the pectoralis major and lower part was dissected free. A strip of muscle about twice as thick as the cavity and about four and a half inches long was dissected, leaving its outer end attached. This was a pedunculated flap. (Fig. 3.) The strip was then turned into the cavity and fixed by two chromic sutures at the outlet of the cavity. A small rubber tube was placed along this strip to the bottom of the cavity to prevent a collection. Wound was sutured, except the central part, which was packed with gauze. (Fig. 4.) Ether and ethylene anaesthesia. Time, twenty-eight minutes. There was no cough after operation and the wound rapidly healed.

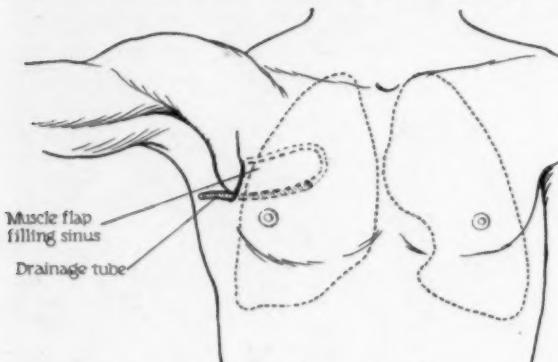


FIG. 4.—Muscle flap transplanted.

October 13, 1926. Weight, 154 pounds; gain of 35 pounds since operation. Is feeling fine; no complaints. Is working. X-ray shows no abnormality at site of cavity.

### ADENOCARCINOMA OF THE APPENDIX

DR. FREDERIC W. BANCROFT presented a man, aged thirty-three years, who on the evening of January 18, 1926, developed an attack of general abdominal pain more marked in the right lower quadrant. He vomited several times. He took a cathartic and immediately vomited. An enema caused a fair bowel movement. Patient was examined by his family physician at 1 A.M. and a diagnosis of acute appendicitis was made. He was given a medicated enema which returned clear. His pain increased and finally localized in the right iliac fossa. At 6 A.M. he was sent to the hospital. On admission to the hospital his urine was negative. His blood count was 16,000 leucocytes with 81 per cent. polymorphonuclear. Temperature 99.5°, pulse 108. Examination showed no distention. There was rigidity of the right rectus and tenderness at McBurney's point. At 8 A.M. there was also some pain and tenderness in the region of epigastrium. He was immediately taken to the operating room. A right rectus incision was made. On inspecting the caecal region a large tumor was found retrocaecal and apparently occluding the ileum at the ileocaecal junction. The small intestine was isolated from the semi-solid material. As the patient's condition was poor and there was considerable distention, it seemed inadvisable to do a complete operation at this time. Therefore, a lateral anastomosis was performed between the ileum at about a foot from the ileocaecal junction and the transverse colon. A small piece of the tumor was removed for examination and wound closed.

The report of the tissue excised was adenocarcinoma, apparently of the appendix. Patient did well following this procedure save that the abdominal wound became infected.

The second stage was performed February 18. At this time the tumor, the terminal ileum and the ascending colon up to the anastomosis, was excised. Considerable difficulty was found in freeing the tumor from the lateral abdominal wall. The ends of the ileum and transverse colon were doubly inverted and rubber dam drain inserted. Wound closed. His convalescence was uneventful.

## RECURRENT OBSTRUCTION OF COMMON BILE DUCT

The pathological report of the specimen removed showed it to be adenocarcinoma of the appendix invaginated into the terminal end of the cæcum and ileum.

He presented this case first because it was an unusual tumor which caused an obstruction, although the symptoms were suggestive of acute appendicitis. Second, a two-stage operation with obstruction is sometimes preferable from the point of safety of the patient to a complete excision and anastomosis at one stage.

DR. NATHAN W. GREEN remarked that the patient was a young man. It seemed to him that surgeons were observing a number of this type of cases and that this type of case was evolving itself into a definite entity—carcinoma of the ileoæcal region in comparatively young persons. He had a similar case in a rather young woman in which he had resected the cæcum and ascending colon and part of ileum in a similar manner. At that time she had enlarged glands in the mesentery, which however did not show tumor cells. She lived in good health for five years; then she drank by mistake some lysol. He saw her in the hospital in a medical ward, but shortly afterward lost track of her.

## RECURRENT OBSTRUCTION OF COMMON BILE DUCT BY BLOOD CLOT

DR. FREDERIC W. BANCROFT presented a man, aged thirty-four years, who on June 10, 1926, developed pain in right hypochondrium, radiating to right shoulder and back. Had extreme difficulty in getting breath. Pain was cramp-like in character. Three days after onset of illness patient became jaundiced. Jaundice continued with occasional attacks of pain until his operation June 16, 1926. At admission to the hospital, clotting time three minutes, bleeding time four minutes. Was given calcium lactate by mouth for twenty-four hours ante-operative.

At operation the gall-bladder, filled with stones, was removed, the common duct opened and several stones removed from it. The operator, after convincing himself that there were no stones in the duct, introduced a rubber tube and sutured the wound in layers. Patient did perfectly well until the eighth day post-operative, when there was some oozing noticed on the dressing. On the ninth day he had a chill associated with an attack of intense pain in the back, which at first was suggestive of a pulmonary infarct. On the tenth day patient was slightly jaundiced with a bloody ooze from the wound with no sign of any bile. Patient appeared acutely ill, vomited some blood, and passed tarry stools. On the eleventh day was taken to the operating room and transfused with 500 c.c. by the Unger method. On account of the blood appearing in the stools and the blood oozing from the wound, and the signs of obstruction of the common duct, a provisional diagnosis of a blood clot occlusion of the common duct was made. The drainage tract was slightly enlarged, and a finger inserted into the wound. With fingers and sponge forceps a large blood clot was removed. Blood clot showed a mould of the common duct about two inches in length. Following removal of the clot, bile escaped. A drainage tube was inserted. Following this the patient did fairly well for two days, but on the third day again had an attack of acute pain, chill, rise in temperature associated with a bloody discharge from the wound and cessation of the bile flow. Patient was again taken to the operating room, anaesthetized and wound opened widely. Another firm clot showing mould of the common duct was removed. A bleeding point which was apparently in the stump of the cystic artery was ligated and a tube again

## NEW YORK SURGICAL SOCIETY

re-inserted in the common duct. Bile escaped from the duct after the removal of the clot. Patient was given sodium chloride intravenously following this operation. Convalescence was uneventful and the patient left the hospital in about three weeks.

DR. GEORGE WOOLSEY said he thought this a rather unusual complication of gall-bladder surgery. In a paper about six years ago, he reported an experience of his own some years ago where a man had been operated on twice for gall-stones; the second time to close a persistent fistula. The second operation was not successful, so that about eight months after the first operation, when he first saw him, he was still draining all his bile through the fistula. Doctor Woolsey found a stone in the common duct, as expected, and a group of stones well up in the hepatic duct, in a pocket on the surface of the liver. He had to use a little force to dilate the duct with the finger enough to move these stones. He put in a tube as usual, and during the first twenty-four hours blood began to ooze from the tube. This bleeding did not amount to very much but he soon became jaundiced. A suction was used with the tube, later removing the tube and applying the suction to the opening, without any effect. In the meantime the jaundice deepened, the temperature rose and there were some chills. On the fourth day a little bile began to appear in the wound and this increased every day, so that in about a week he was draining a good deal of bile, and there was a good deal of bile in the stools. The man made a complete recovery.

### MALIGNANT TUMORS OF THE THYROID

DR. EUGENE H. POOL read a paper with the above title, for which see vol. lxxxv, page 120.

DR. ALEXIS V. MOSCHCOWITZ said that a number of years ago he stated that there were two kinds of carcinomas of the thyroid glands, one in which the pathologist makes the diagnosis and one in which the surgeon makes the diagnosis. In his experience, the first group gives a much better result than the second group; in other words, the early cases of carcinoma give a much better final result than the neglected cases.

He was not as a rule a very ardent advocate of X-ray therapy. He has had, however, in the last few years, a number of cases in which radio-therapy certainly did wonders. He recalled one case particularly which had progressed so far that the carcinomatous process involved both the trachea and the thyroid cartilage, so much indeed, that there was undoubtedly carcinomatous tissue left attached to this structure. The patient received energetic X-ray treatment and up to date, fully three years after operation, is not only alive, but is well. Since that time, Doctor Moschcowitz has had other cases, and he was so much impressed by the first case, that he is rather in favor of post-operative radiation in carcinoma of the thyroid gland.

DR. SEWARD ERDMAN said that in some instances the development of metastasis will prove to be the first indication that carcinoma of the thyroid has existed. As an illustration of this fact he cited the case of a man, sixty-one years of age, upon whom he had operated in February, 1925, for a large

## PARTIAL RESECTION OF RIGHT LOBE OF LIVER

malignant tumor of the upper abdomen. The abdomen contained blood-stained fluid and there were metastatic nodules distributed over the peritoneal surface. However, the principal mass was found to lie high in the abdomen and was definitely retroperitoneal. The stomach, gall-bladder and intestines nowhere showed evidence of primary involvement. A node taken from the gastrocolic omentum was reported by the pathologist as metastatic adenocarcinoma. This case is of interest because just one year before the exploratory abdominal operation, Dr. John Rogers had operated upon this man, performing a partial thyroidectomy. Six months before Doctor Rogers' operation the man had developed an "abscess" in the right lobe of the thyroid in which region he had had a swelling, probably adenoma, for many years.

The abscess was opened by his physician, drained pus, and had never completely healed. There was a sinus into the thyroid tissue at the time Doctor Rogers operated. The pathologic report on the thyroid tissue discussed the presence of multinuclear, foreign body giant cells and some atypical epithelial cells with colloid goitre in other portions of the gland. No diagnosis of carcinoma of the thyroid was made, but in view of the early development of carcinoma elsewhere one may consider that a small carcinoma of the thyroid was the primary lesion.

DR. BURTON J. LEE said that there was marked variation in the pathology of malignant tumors of the thyroid, those which proved to be of embryonal type were more radio-sensitive than those in which the tumor cells were of adult type. Doctor Craver, of Memorial Hospital, has reported eighty-three cases of thyroid malignancy. One case which came under Doctor Lee's immediate attention, with recurrences in the scar following operation, yielded satisfactorily to low voltage X-ray treatment. This patient still has no evidence of disease, three years after operation.

*Stated Meeting Held November 24, 1926*

The President, DR. WALTON MARTIN, in the Chair

## PARTIAL RESECTION OF RIGHT LOBE OF LIVER FOR HEPATOMA

DR. HERMANN FISCHER presented a specimen and microscopic slides, to which was attached the following history:

About six months ago, while in Florida, a woman began to suffer from weakness, general malaise and fever ( $101^{\circ}$  F.). A short time later she noticed a lump in right lower quadrant of her abdomen. This lump was quite movable. She was able to move it from the right lower quadrant upward and back to the right lateral wall. It soon began to grow much larger and patient began to have some pain in the vicinity of the tumor. The pains frequently radiated to the right costal margin and were so severe that she was obliged to go to bed. These pains were very frequent several months ago, but now do not recur unless she remains on her feet for a long time. There are attacks of fever usually in the afternoon or evening. The temperature occasionally goes to  $102-103^{\circ}$ . Rest in bed usually reduces these attacks of fever. She lost twenty pounds in weight in first four weeks of illness.

Examination showed no evidence of abnormal conditions of the thoracic organs.

## NEW YORK SURGICAL SOCIETY

On inspecting the abdomen a distinct fulness of the right hypochondriac region could be noticed and on deep respiration a large, round, smooth mass could be seen moving under the abdominal wall from the lower border of the ribs to three fingers' breadth below the umbilicus. On palpation this tumor was smooth, almost round, painful on palpation, especially at its lower border and could be moved toward the median line with perfect freedom. It had an elastic feel, like a cyst containing fluid under pressure. The percussion note was dull and this zone of tumor dulness merged into the liver dulness.

The impression was gathered from the palpitory findings that the growth was most probably with an intraperitoneal intimately connected with the right lobe of the liver.

*The Graham test* showed the gall-bladder distinctly outlined from the large shadow of the tumor, it seemed to be normal, except that it was pushed inward, close toward the spine by the growth.

*A pyelogram* outlined the calyces of the kidney, and except for a slight dilation showed no abnormality. The kidney shadow was also distinct from the large shadow of the tumor in front.

It was therefore assumed that the new growth was situated in the right lobe of the liver. A negative Wassermann test spoke against a gumma of the liver.

At the operation the following condition was found:

A median line incision from ensiform cartilage to umbilicus was made, combined with a transverse incision through the right rectus muscle.

The much enlarged right lobe of the liver was adherent to the transverse colon and omentum. After severing the adhesions this lobe of the liver which was the seat of a tumor the size of a baby's head, could easily be lifted out of the abdomen. The tumor was solitary, soft and of a grayish-white, mottled color. Aspiration revealed no fluid. Its inner border encroached upon the gall-bladder which was normal. Careful exploration of the abdomen showed that no other tumor masses were present.

The gall-bladder which was in close proximity to the tumor was excised first. Two elastic intestinal clamps were then applied above the tumor and carefully closed, tight enough to compress the parenchyma of the organ, enough to prevent hemorrhage without tearing the surface of the liver. The diseased part of the lobe of the liver was then removed with the Pacquelin cautery. There was no hemorrhage. The cut surface of the liver was seared with the Pacquelin, the compression of the clamps on the stump was then released somewhat by slightly opening the clamps, after a few seconds some large vessels in the parenchyma started to bleed; each of these was clamped and tied. After all vessels were tied, the clamps were again tightly closed and an interlocking chain suture of chromic gut applied behind the branches of the clamps. The clamps were then removed and no hemorrhage occurred. The outer surface of the liver parenchyma was perfectly dry. Several layers of iodoform gauze were put upon the outer surface of the liver, a small cigarette drain was inserted down to the ligated cystic duct, and the abdominal wound closed, the tampon being led out at the upper angle of the wound.

The patient stood the operation very well.

Her pulse-rate was high for the first five days after the operation, 130-140, but of good quality.

On the third day post-operative patient developed a pneumonia in the left lower lobe which had disappeared after two weeks.

Three weeks after operation the temperature again rose to 102°. Patient complained of pain in liver region.

## PARTIAL RESECTION OF RIGHT LOBE OF LIVER

The wound which in the first four days had drained bile profusely had almost closed, but its granulations looked edematous.

After three days the fistula opened spontaneously and wound drained quite an amount of pus, whereupon the temperature dropped to normal and her pain stopped.

*The pathological examination* of the specimen showed the following:

*Gross Appearance.*—The specimen consists of a tumor with some liver tissue and a gall-bladder. The tumor which has been split open measures  $12 \times 10 \times 6$  cm. The external surface is smooth, slightly reddened and contains a few adhesions. There are many small nodules ranging in size from a marble to a pea on the external surface. The tumor has not broken through the capsule of Glisson, which is markedly thickened over it. On section the tumor is seen to be fairly well localized. At both ends there is a narrow rim of liver tissue. The tumor itself is divided into many lobules by bands of connective tissue. The lobules vary markedly in size, shape and color. Some are soft, somewhat translucent and bile stained. Others are yellow, granular and seem necrotic. In others there are small hemorrhages and deposit of black pigment.

The gall-bladder measures  $8 \times 3$  cm. The external coat has some adhesions, but is not injected. The wall is not thickened. The mucosa is velvety and not injected. Diagnosis: Hepatoma. Chronic catarrhal cholecystitis.

*Microscopical examination* of the tumor shows a tumor composed of large polyhedral cells. The cytoplasm of these cells is granular and slightly acidophilic. The nuclei are centrally placed and have a vacuolated appearance. Mitotic figures are not demonstrable. Broad sheets of these cells are surrounded by more or less dense septa of connective tissue. These septa are occasionally infiltrated with round cells. The epithelial cells resemble liver cells very markedly and the structure differs from adjacent liver tissue only in that the cells are not arranged in columns. In the tumor there are a fair number of thin-walled blood-vessels and there are extensive areas of necrosis. The liver tissue surrounding the tumor show areas of round-cell infiltration. Surrounding the neoplasm is a capsule of rather dense connective tissue in which tumor cells are absent.

Other sections show a gall-bladder in which there is some papillary over-growth of the mucosa. The submucosa is slightly thickened and congested.

DR. DEWITT STETTEN said he had seen the fresh specimen immediately after resection. The tumor had certain definite characteristics. It was soft, more or less encapsulated, and on cut section the tissue was distinctly greenish-yellow in color, suggesting that the tumor was composed of liver cells, actively secreting bile. In a somewhat similar case reported in the Proceedings of the New York Pathological Society, 1921, the patient unfortunately suffered from multiple tumors, and it was only possible to remove one of the tumors for microscopic examination. It was interesting to note that in this case the patient subsequently developed an entirely different form of tumor, namely a squamous-cell epithelioma of the esophagus for which a gastrostomy was done, which eventually led to the patient's death, and which was demonstrated at the post-mortem examination. It was found that the liver was filled with larger and smaller hepatomatous nodules and that both lungs were invaded by metastases which were of the same character as the primary liver tumor.

## NEW YORK SURGICAL SOCIETY

### PARTIAL RESECTION OF STOMACH FOR CARCINOMA

DR. HERMANN FISCHER presented a woman, who about six months ago became very anaemic. Her haemoglobin fell to 50 per cent. She was transfused, improved after that and discharged.

Later progressive weakness again developed. No vomiting, no pain in stomach, bowels regular, *appetite good, no loss of weight.*

Previous history negative. Mother and grandmother died from cancer of stomach.

Very anaemic; no masses to be felt in the abdomen and no pain whatever on palpation. Blood (before transfusion): 2,390,000, haemoglobin 40 per cent.; after transfusion, 3,180,000, haemoglobin 50 per cent.

X-ray examination showed a stomach large in size and normal in shape and appearance. There was a very marked, persistent deformity seen in the antral portion of the stomach. It involved both the lesser and greater curvature and extended up to the pylorus. Beyond the pylorus a large, regular cap could be filled.

At the sixth hour there was a fairly marked retention in the stomach and the deformity in its antral portion was accentuated.

The deformity to the stomach, combined with the six-hour retention, strongly suggested the possibility of a new growth in this region.

A median line incision made September 20, 1926, revealed at the lesser curvature of the stomach near the pylorus, a hard indurated tumor about the size of a silver dollar. There was no glandular involvement along the lesser or larger curvature of the stomach.

The liver and gall-bladder seemed to be normal.

Therefore, a subtotal resection was done after Billroth II and Balfour-Polyá modification.

The specimen showed an ulcer with a deep crater the size of a quarter, its edges indurated and everted.

*Pathological* examination showed the ulcer to be a carcinoma.

The patient rallied well after the operation and made an uneventful recovery. Three weeks after operation her haemoglobin had gone up to 60 per cent.

To-day (November 22), two months after the operation, she feels very well, has gained in weight and strength.

This case was shown as a type in which the difficulty of arriving at an early diagnosis of carcinoma of the stomach is exceedingly great. At the same time it proves the great value of careful X-ray examination.

In this case there were no clinical symptoms at all referable to the stomach, she had a good appetite, no vomiting, no bleeding, no pain, and in spite of this the operation revealed a large carcinomatous ulcer. The only symptom of a serious organic disease was the extreme secondary anaemia from which the patient suffered.

The cause of this condition was only detected by the careful X-ray examination, which alone made the diagnosis possible.

### INTR AHEPATIC GALL-STONES

DR. HERMANN FISCHER presented a woman, thirty-nine years of age, who was admitted to the Lenox Hill Hospital with the following history:

About fifteen months ago she had a pain in the right upper quadrant which radiated to the back and the right shoulder. These attacks were quite frequent during the last fifteen months. The pains would last from two to four hours and occur at varying intervals. The pain sometimes occurs at night and is aggravated when lying on the right side. In the interval the

## CARCINOMA OF STOMACH

patient has a sore feeling and gaseous eructations. Her appetite is poor. No blood in stool, no vomiting. She has lost forty pounds since the onset of her illness. No jaundice. She sometimes has a chilly sensation with the attacks.

Her thoracic organs were normal. The abdomen was soft, scaphoid type. There is palpable a small mass the size of a plum just to the left of the umbilicus. No other masses in abdomen. No tenderness. X-ray examination of stomach showed no pathology. Chemical analysis of stomach contents showed hyperacidity, no blood.

*Operation.*—October 2, 1926. Median line incision from ensiform cartilage to umbilicus. Stomach and duodenum normal. Gall-bladder thickened, contains numerous small stones, one impacted in cystic duct. Ectomy.

In the right lobe of the liver numerous white and hard nodules are felt and seen near the thin edge of the lobe under Glisson's capsule. They are of a whitish color and suggest carcinomatous metastases. On closer examination, however, they were found to be of a chalky consistency. Some of the nodules were near the surface of the liver, others were deeply imbedded in the parenchyma of the organ. As they were massed close together and as no other nodules were found in the liver, a wedge-shaped piece of liver which contained the concretions was resected. The defect in the liver was closed by suture. Small cigarette drain to cystic duct, closure of wound around drain.

The nodules in liver substance are intra-hepatic; stones size of a pea.

*The microscopical examination* of the section of liver tissue carrying stones shows slight thickening with hyaline degeneration of the capsule. The parenchyma shows degenerative changes with localized atrophy of the liver cells. There is a thickening of the interlobular fibrous tissue.

*The chemical examination* of the stone showed it to consist essentially of calcium phosphate mixed with some cholesterol. The pigments are not present.

The other gall-stones from the gall-bladder are the usual cholesterol-bilirubin stones.

DR. ALLEN O. WHIPPLE said that the only case he had ever seen clinically or at the time of operation which was of this nature involved so much of the liver that it was impossible to do anything with it. The patient was a Chinaman who had been operated on for gall-stone disease and the gall-bladder had been removed. At that time stones had been found in the common duct. There was a certain amount of detritus which Doctor Whipple considered as indicating a bad prognosis. The strange part of the case was that this patient did fairly well after this operation, the jaundice clearing up. Four months later, however, he came back to the hospital deeply jaundiced. At operation it was found that there were many stones and soft detritus in the common duct and there was an extensive biliary cirrhosis. The man died two or three days after this operation, and at autopsy over 650 stones were found extending out as far as the extreme limits of the ducts, some fairly large, and with the stones there was a considerable amount of the same detritus material.

## CARCINOMA OF STOMACH. NINE YEARS AFTER OPERATION

DR. WINFIELD SCOTT SCHLEY presented a man, fifty-six years of age, who was admitted to hospital June 1, 1917, and discharged June 29, 1917. Operation, resection of pyloric one-third of stomach, posterior gastro-

## NEW YORK SURGICAL SOCIETY

enterostomy, suture of trans-mesocolon to posterior wall of stomach. The patient had complained of sixteen years' duration of epigastric distress and gas with constipation. Catharsis always relieved his symptoms. Distress for six months before entrance worse, but there had been no vomiting. Had not noticed blood in the stools. X-ray examination showed filling defect at pyloric third and shadow residue three inches in diameter after six hours. Glands in the lesser omentum and along the greater curvature considerably enlarged (up to 1 cm. diameter), but were not involved microscopically. Patient made a good convalescence and has remained well nine and a half years.

### CICATRICIAL CONTRACTION FOLLOWING BURNS

DR. WINFIELD SCOTT SCHLEY presented a little girl, eight years of age, who, several years before her entrance into the hospital on February 4, 1926, was badly burned (to the third degree) on neck, chest, shoulder and right arm. This had resulted in severe contractures of the neck and arm. The chin could not be elevated and the arm could not be abducted over 20 degrees from the side. In the neck the worst of the scar tissue was outlined and dissected from the deeper layers. It was found that even the muscles were involved and the superficial layers replaced by scar tissue. The skin and subcutaneous tissue upon the sides of the neck were dissected up and freed almost to the trapezius edge. Upon the left side an incision was made just above the clavicle, allowing the left flap to be drawn up to the maxilla. After this free dissection the left and right flaps could be approximated by sliding in the midline and held by fine silk. The skin in so young a child being quite elastic, it was even possible to extend right and left flaps across the midline to make up for deficiencies on either side. A quick primary union resulted with restoration of neck function. The area above the clavicle upon the left side was not drawn together but later skin grafted.

The arm was freed from the side by an incision directed towards the apex of the axilla and carried up to the edge of the major pectoral muscle, and superficially a little above both in front and behind this level. The arm could now be freely abducted and extended. It was possible, due to the high skin mobility, to slide a flap from the side of the chest to cover this whole defect of the axilla. Careful attention was paid to the dressing at the time of operation, and firm yet elastic pressure with comparative immobility of the arm was maintained for the first week. Primary union again resulted and complete arm motion and function were restored.

For further cosmetic effect future procedures may be planned, the ones described having been solely to restore function, but an enormous gain in appearance has resulted as well.

DR. HUGH AUCHINCLOSS considered that the main feature in correcting these contractions in the neck was in the avoiding of a longitudinal scar. Many of the cases that come for relief have been operated on frequently beforehand, and longitudinal scars have resulted in most of them.

DOCTOR SCHLEY added that he had had this point in mind and had attempted to avoid a midline contracture by staggering the flaps. The result, as could be seen, was most satisfactory and presented no evidence of contractual effect.

## OBSERVATIONS ON CARCINOMA OF THE STOMACH

### SKIN GRAFT FOR WEB FINGERS

DOCTOR SCHLEY presented a little girl, three years of age, on whom he had operated for completely webbed fingers resulting from extensive burn of the left hand. On admission to the hospital the fingers were found to be all fused to the terminal phalanges. The result, a year and a half after operation, shows complete separation of fingers to head of metacarpals with perfect functional and cosmetic result. This was accomplished by deeply dividing the webbing down to and between the heads of the metacarpals and Thiersch skin grafting, the graft being carried well down to the bottom of the incision and kept there by a narrow bandage pulled well down between each finger. The incision and graft were carried well down to avoid the tendency to heal back and obliterate the deeper part of the cleft. The graft, cut nearly to the length of two fingers, was then carried along the cut surface, exposed on both sides, covered with gutta percha tissue and the fingers and hand carefully bandaged and immobilized on splint. There was a 100 per cent. take in the grafts.

## OBSERVATIONS ON CARCINOMA OF THE STOMACH BASED ON A FOLLOW-UP STUDY OF SURGICAL TREATMENT

DR. FORDYCE B. ST. JOHN read a paper with the above title and presented five of the patients whose cases were reported in the paper.

DR. ALLEN O. WHIPPLE considered that it was not generally realized what a remarkable amount of work and careful study was required in order to carry out such an analysis as that presented by Dr. St. John, not to speak of the many hours spent in the follow-up clinic. The actual results, however, are to be determined only by actually seeing the patients. One can be very easily deceived if one depends on the patients' statements alone.

There were two things Doctor Whipple wished to emphasize and the first was the importance of early diagnosis. From a study of these cases one was struck by the importance of a history of loss of weight, loss of strength, diminished appetite and asthenia, and these symptoms should be regarded with the greatest concern. That particularly holds true in the medical clinics, where these patients are usually seen first. Much valuable time had been lost in the cases in this series. The next important point is the fact that one cannot determine the operability by what appears to be lymph-node involvement or the size or the character of the mass felt in the stomach itself. Of the five cases shown here this evening there was doubt in three that the case was a fit one for radical resection. In the one that was living the longest time after resection, Doctor Lambert, who operated, had doubted the wisdom of removing a growth of that size. From the fact that only one of these cases had lymph-node involvement, it appears that enlargement of the nodes should not be a deciding factor in resection. The finding of a mass at the time of operation or before is not an indication of the possibility of resection in cases of this sort. The fact that in such a large percentage of the cases of the entire series liver involvement was present may explain why so many of these cases die rapidly when no local extension is discovered at the time of operation.

## NEW YORK SURGICAL SOCIETY

DR. NATHAN W. GREEN remarked further on the importance of early diagnosis. In making that diagnosis, other things being equal, weakness and loss of weight were the two most important symptoms. The diagnosis then might be checked up by X-ray. The second point was, it was very desirable to instruct or encourage the general practitioner in the understanding that carcinoma of the stomach was not necessarily a hopeless condition. That opinion seemed to prevail throughout the profession both in the city and in outlying districts. If that could be overcome patients would come to the hospital in a more favorable frame of mind and if there were a chance promised them by the surgeon they would be more likely to accept it.

DR. JOHN DOUGLAS said that Doctor St. John's statement that the average duration of the symptoms was eight months, the longest three years, and the shortest a few days, was of interest as an indication that probably none of these cases were a conversion of a gastric ulcer into carcinoma of the stomach. Another point that no one had called attention to was the fact that in the follow-up of these cases, the average case occurred in the fifth decade of life and frequently in the sixth. If one follows these cases after that, life insurance statistics will show that death is apt to occur, in the ordinary course of events, from other diseases earlier than in a younger age group.

DR. HUGH AUCHINCLOSS, referring to Doctor St. John's statement that all the cases were checked by biopsy, said that this was very important. Many times at an exploratory laparotomy a large mass may be found in the stomach, assumed to be carcinoma, and no specimen removed for examination. This patient may or may not live for a long time afterward with the diagnosis always a questionable one. An effort should be made to at least remove a neighboring lymph-gland in all cases where the procedure wont harm the patient.

DR. HERMANN FISCHER said that every time he heard such statistics as those of Doctor St. John he felt encouraged in continuing to attempt the operative cure of these cases. The size of the lesion should not militate against operation; he had noted many times that where cases looked almost hopeless operation proved to be very satisfactory and the metastatic condition in the lymph-nodes was very small. On the contrary, many very small growths had proven to be highly malignant. He believed that every case of carcinoma of the stomach should have the benefit of exploration.

DOCTOR ST. JOHN, in closing, said one is impressed with the relative prognosis in these cases. One will see an apparently rapidly growing carcinoma operated on and the patient will be found alive eight years later. Another patient with a growth which seems small will be dead soon after operation. There had been a tendency to get away from the retrocolic type of operation in this series, except the Billroth II, and in all cases, except one, where a long loop ante-colic anastomosis was used, it was accompanied by an enter-enterostomy.

TRANSACTIONS  
OF THE  
PHILADELPHIA ACADEMY OF SURGERY

*Stated Meeting Held December 6, 1926*

The President, DR. CHARLES F. MITCHELL, in the Chair

ETHYL CHLORIDE IN LOCAL ANÆSTHESIA

DR. JOHN B. CARNETT demonstrated a method of securing satisfactory local anaesthesia with ethyl chloride. The skin and subcutaneous fat overlying a superficial abscess can be completely anaesthetized by spraying with ethyl chloride but the inflamed hypersensitive tissues beneath the abscess are not influenced by this anaesthetic. The usual practices of making an incision either by a simple heavy stroke of the knife or by transfixion and cutting from within outward, transmit pressure or pull through the abscess to the adjacent non-anaesthetized tissues causing great pain. By using a thin-bladed sharp knife and making pressure, too gentle to be transmitted to the depths, all pain is avoided. This may require two to six gentle knife strokes to cut through the perfectly anaesthetized tissues overlying the abscess.

The most satisfactory container for ethyl chloride is the one having a screw valve to regulate the size of the stream. The nozzle of such a container can be held within two or three inches of the abscess and by adjusting it to a very fine spray, anaesthesia results very promptly. The stream from a valveless container is so coarse that even when sprayed from a distance of 16 to 18 inches the ethyl chloride does not evaporate properly, hence anaesthesia is delayed, solution is wasted, unevaporated solution tends to flow into undesired situations as into the eye, and the area to be anaesthetized cannot be so accurately circumscribed. Manufacturers of valveless sprays should be condemned for their practice of sending printed instructions to blow on the surface to expedite evaporation of the solution. Blowing tends to contaminate the surface and succeeding wound with a variety of pathogenic germs from the surgeon's mouth.

Four or five years ago he adopted ethyl chloride as the preferred local anaesthetic for taking biopsies from ulcers suspected of being cancerous, the danger of embolism of cancer cells is increased by the injection of anaesthetic solution but is minimized by freezing which tends to hold the cells *in situ* during the incision.

CHRONIC STRAIN OF THE LUMBAR SPINE AND SACRO-ILIAC JOINTS

DR. JOHN B. CARNETT read a paper with the above title.

DR. DAMON B. PFEIFFER remarked that Doctor Carnett's theory is a very ingenious and possibly satisfactory explanation for certain cases of the ten-

## PHILADELPHIA ACADEMY OF SURGERY

derness which is frequently elicited in the right and left iliac fossæ. Some years ago Robert Morris maintained that tenderness in this same location was an important sign of chronic appendicitis, his explanation being that chronic disease of the appendix gave rise to a state of irritation and tenderness over the lumbar ganglia.

At the last meeting of the American College of Surgeons in Philadelphia, the speaker had occasion to participate in a consultation with Sir Arbuthnot Lane in a case of carcinoma of the transverse colon. The condition was sufficiently obvious, but he was especially interested in Sir Arbuthnot's method of abdominal examination. He laid great stress on tenderness in the same locations pointed out by Doctor Carnett. His interpretation of the matter was that carcinoma was a sequence of intestinal stasis and this in turn by causing strain on supporting intestinal ligaments, gave rise to the obvious tenderness in the right and left iliac fossæ.

In the presence of such differences of opinions the matter cannot be regarded as settled. There is no question that many appendices are being removed largely on the evidence of tenderness in the right iliac fossa, and it is well to realize that there are other pitfalls in the diagnosis than the well-known sources of error such as renal and ureteral disease, pelvic disease, lymphatic glandular inflammation and other rarer conditions.

### RESULTS IN GALL-BLADDER SURGERY

DRS. E. L. ELIASON and L. K. FERGUSON read a paper with the above title.

DR. GEORGE P. MULLER remarked that in this subject the primary mortality is of first importance and he was pleased to note that Eliason and Ferguson had grouped their cases according to pathology and not according to operation, cholecystectomy or cholecystostomy as is so often done. It makes little difference which operation is done in chronic gall-bladder disease, with or without stones. The mortality is negligible and dependent upon other factors than the type of operation. In acute empyema of the gall-bladder the case is different and here the mortality from cholecystectomy is higher than cholecystostomy. There is need for discrimination even if a secondary operation is necessary later.

In the common duct group he was somewhat at a loss to find the reason for his high mortality. He delays operation and practices careful pre-operative care. Perhaps it would be better to tap the gall-bladder if it will drain or the common duct if that is necessary and leave the removal of the stone, as suggested by Crile, to a later time. It certainly is a mistake radically to "spoon" the ducts in a sick patient. These patients often have a pancreatitis and extensive liver involvement and correct post-operative treatment is essential. Blood transfusion and glucose intravenously are routine on his service.

End result studies are not always easy. In his own hospital the follow-up is highly efficient but the patients are not followed for a sufficient length of

## POST-OPERATIVE WATER METABOLISM

time. In a paper from the Mayo Clinic published last summer, it was noted that cases considered as cures came back many years later with recurrence of the gall-stones. In the series which he reported last year 85 per cent. of the chronic gall-bladder group with stones and 70 per cent. of the simple cholecystitis claimed perfect health. The difference probably represents the margin of failure to cure the complete pathology. He had been working on this last group lately. It seemed to make no difference whether or not the appendix was removed concurrently, nor was age a factor. The end results are apparently a matter of correct diagnosis, precise operating, and the avoidance of drainage whenever possible. However, he had 90 per cent. of perfect results in the empyema group and 76 per cent. of cures in the common duct cases, both of which were extensively drained.

In regard to anaesthesia, he now uses local anaesthesia and ethylene. Impressed by the use of posterior splanchnic anaesthesia in the hands of Eliason and Ferguson, he tried it in a few cases, but the marked fall of blood-pressure was very alarming, even though all of his cases recovered.

DOCTOR ELIASON remarked that the alarming fall in blood-pressure which accompanied splanchnic anaesthesia had been obviated by reducing the amount of adrenalin used. He now uses only half the amount which he formerly employed.

## INTRADERMAL TEST FOR THE DETERMINATION OF POST-OPERATIVE WATER METABOLISM

DRS. KENNETH E. APPEL and SELLING BRILL read a paper with the above title.

DR. GEORGE P. MULLER said that this test seems at first a trifling one, the producing of a wheal and the watching of the wheal disappear. But it has given rise to the most interesting amount of speculation about acidosis and water metabolism. He thought when they first started this work that local acidosis would explain the phenomenon. In one case of diabetic gangrene they were interested to know whether to amputate below or above the knee. The disappearance time was 40 above the ankle, 50 in the calf, and 60 at the knee; according to this test he could safely amputate below the knee. This was done even though he knew how dangerous it is in the average case. The stump has done well.

According to the later theory, however, the test seems to relate to an entirely different thing and has nothing to do with acidosis. As a means of determining whether or not the patient is in need of water, the test may hold promising possibilities.

DOCTOR BRILL said that they were not at all certain of the value of this test in interpreting post-operative water metabolism; the mechanism and the disappearance of the wheal is not at all understood. Originally, workers with this intradermal wheal attempted to explain it on the basis of the work of Martin Fischer, who pointed out that colloids imbibed water when their acidity was increased. Fischer further believed that there was a local

## PHILADELPHIA ACADEMY OF SURGERY

acidosis of the tissues, and this caused an imbibition of water. On this basis he attempted to explain all types of oedema. That there may be a local acidosis has been recently confirmed by the work of Rous at the Rockefeller Foundation.

However, especially since the publication of Loeb on "Proteins and the Theory of Colloidal Behavior" in 1922, this theory of Fischer's has been discredited because Loeb showed that this imbibition of water with increased acidity took place at a pH below the isoelectric point, and that there was also a swelling of the colloid with increased alkalinity on the alkaline side of the isoelectric point. The isoelectric point of most of the body proteins is in the neighborhood of a pH of 4.7 to 5. Physiological processes in the body take place at a pH of 7 to 7.4. Therefore increased acidity would be expected to cause a decrease rather than an increase in the absorption of water by the body colloids at this pH. As a matter of fact there is no doubt that a shift of water between cells, lymph, and serum takes place with a change in pH. However, in which direction this shift takes place it is premature to attempt to state at this time.

The disappearance of the wheal post-operatively might perhaps be explained by considering the relation between the capillary pressure and the osmotic pressure of the blood. Post-operatively, there is perhaps a dehydration which causes an increase in the osmotic pressure of the blood and therefore a more rapid disappearance of the wheal. This is in line with the explanation given for oedema by Starling in his book on *Human Physiology*. They are now at work on this problem.

NOTE.—Since the presentation of this paper, further work, under direction of Dr. J. H. Austin, has shown that the above explanation is probably incorrect.

### USE OF THE RUSSELL APPARATUS IN THE TREATMENT OF FRACTURE OF THE SHAFT OF THE FEMUR

DR. THOMAS J. RYAN read a paper with the above title.

DR. DAMON B. PFEIFFER said that this method is a valuable addition to the treatment of fractures. It employs the principle of balanced traction in a most ingenious manner and if general experience bears out the satisfactory character of the results as reported here, it should be widely adopted. Apropos of the fact that quite a number of the cases reported in this paper were children, he would mention two features which are valuable to remember.

The first is, that it is comparatively easy to "set" a transverse fracture of the femur in children. Of course it is useless to attempt to replace spiral or oblique fractures by manipulation, but in the case of transverse fractures, by a combination of traction and manipulation, it is nearly always possible so to lock the fragments as to make the after-treatment a very simple matter. The most effective manœuvre in bringing about this end-to-end apposition is to angulate the bones sharply with traction on the distal fragment and then, holding the bones in alignment in the plane of angulation to bring them

## FRACTURE OF THE SHAFT OF THE FEMUR

slowly up to their normal position. Even when the fracture has existed for some days and overriding is extreme so that direct traction will not succeed in reducing the shortening, it is usually possible to lock the fragments in this manner. Recurrence of deformity may be prevented readily by coaptation splints and fixing the leg in suspension with just enough traction to effect immobilization. He was not referring, of course, to supracondylar fractures or those of the upper end of the femur, but only to those which occupy a position somewhere within the middle two-fourths of a long bone.

The second important consideration in the treatment of fractures in children is the fact well-known to those who have had experience in the treatment of acute fractures during the early years of life, that growing bones have a truly marvelous ability to correct malpositions and even shortening due to lack of correct anatomical reposition after fracture. Ashhurst has called attention to the way in which function and muscle balance shape the skeleton in childhood. Truesdell, Speed, and others have shown vividly that misalignment and shortening may be almost disregarded in early childhood. A fractured long bone is stimulated to increased growth by the fracture, and if shortening is present it soon overtakes its fellow on the opposite side. Angulations and overriding are so compensated that it is often difficult after the lapse of a year or two to discover either by examination or by the X-ray where the site of fracture has been. He ventured to speak of this at some length because these factors are not generally appreciated. About two years ago in taking over a surgical service from one of his colleagues in a hospital in this city, he found in the children's surgical ward a small boy about five years old who had had a fracture of the middle of the femur. He had been treated by the overhead suspension method of Bryant. The alignment was good and the shortening not more than a half inch. Callus had already formed and the fracture was fairly stable. Relying on the facts just stated he felt that the end result would be not only good, but perfect, and in due time arranged to send the child home. Unfortunately in this case one of the members of the family happened to be a nurse from another city and she asked to see the X-ray and was horrified to find the position of the fragments as he had just described them. He explained to her the prospects, but it developed that with a true layman's horror of X-ray deformities she took the child to see a well-known surgeon in this city, whose work is not with acute fractures but with chronic bone conditions, and to the speaker's great surprise he sent the child back to the hospital, broke up the union, and put on a plate. A better appreciation of the behavior of fractures in children would be a safeguard against the perpetration of bad surgery of this sort.

DR. J. TORRANCE RUGH remarked that every one of these cases presents its own problems. The results shown by Doctor Ryan are certainly good and yet when one tries extension in other cases and after a most thorough application of the extension for a period of ten days or perhaps two weeks, one fails to get apposition and fails to overcome the overlapping—then one wonders how it is that the extension always succeeds in the cases reported.

## PHILADELPHIA ACADEMY OF SURGERY

It is his practice to operate, if after ten days, apposition of the fragments cannot be secured.

DR. A. P. C. ASHHURST said that it is a pleasure to see surgeons take an interest in fractures of the femur, even if it requires a new and complicated apparatus to interest them. In all probability, the same results can be obtained by simpler means, but if it takes a complicated apparatus and a newer method to interest them, let us have it. Doctor Ashhurst agrees with Doctor Pfeiffer in that he never saw a fracture of the shaft of the femur in a child which did not give a good result, no matter what the treatment. To operate for malunion, in a case such as he has described, would seem to border on malpractice.

DR. GEORGE P. MULLER said that this method of treating fractures of the femur is not new in principle but has brought out several interesting points. The results obtained are probably no better than those which Doctor Ashhurst reported to the American Surgical Association as having been secured by Buck's extension, but the dressing is exceedingly uncomfortable for the patient and the results speak for themselves. It is true that they plated several of the cases, but then the method is not infallible and there will be occasional failures. In addition to the fractures of the shaft reported, they had several cases of fracture of the neck of the femur with good results and there was one pathologic fracture of the femur secondary to carcinoma of the prostate which healed in perfect position. They had one case of peroneal palsy in which a simple sling was used under the knee and with the leg on a pillow. This apparatus is more comfortable than a plaster case and patients seem to like it better than the Buck's extension.

Replying to Doctor Rugh's remark, Doctor Muller said that he operated on three of the twenty patients; one without reason, and one maybe without reason, and the other because he could not get reduction. Patients require attention with the Russell apparatus. If shortening recurs when the weight is removed, it means interposition of the tissue between the fragments. In the cases reported he secured perfect apposition.

### CHANGE OF EDITORIAL ADDRESS

The office of the Editor of the *Annals of Surgery* has been changed to 489 Washington Avenue, Brooklyn, New York. All contributions for publication, Books for Review, and Exchanges should be sent to this address.

Remittances for Subscriptions and Advertising and all business communications should be addressed to the

### ANNALS of SURGERY

227-231 South Sixth Street

Philadelphia, Penna.